1 OF 1

FOR OFFICIAL USE ONLY

JPRS L/8473

22 May 1979

U S S R

TRANSLATIONS ON USSR RESOURCES
(FOUO 12/79)

U. S. JOINT PUBLICATIONS RESEARCH SERVICE

FOR OFFICIAL USE ONLY

NOTE

JPRS publications contain information primarily from foreign newspapers, periodicals and books, but also from news agency transmissions and broadcasts. Materials from foreign-language sources are translated; those from English-language sources are transcribed or reprinted, with the original phrasing and other characteristics retained.

Headlines, editorial reports, and material enclosed in brackets [] are supplied by JPRS. Processing indicators such as [Text] or [Excerpt] in the first line of each item, or following the last line of a brief, indicate how the original information was processed. Where no processing indicator is given, the information was summarized or extracted.

Unfamiliar names rendered phonetically or transliterated are enclosed in parentheses. Words or names preceded by a question mark and enclosed in parentheses were not clear in the original but have been supplied as appropriate in context. Other unattributed parenthetical notes within the body of an item originate with the source. Times within items are as given by source.

The contents of this publication in no way represent the policies, views or attitudes of the U.S. Government.

JPRS L/8473

22 May 1979

TRANSLATIONS ON USSR RESOURCES

(FOUO 12/79)

CONTENTS

PAGE

ELECTRIC POWER AND POWER EQUIPMENT

Fourth All-Union Scientific-Technical Conference on Electric Power Quality
(I. V. Zhezhelenko; ELEKTRICHESTVO, Mar 79) 1

Ways for Raising Construction Efficiency of 750KV Overhead Lines
(I. M. Shapiro; ENERGETICHESKOYE STROITEL'STVO, No 12, 1978) 9

Brief Notes on Construction Starts and Accomplishments
(GIDROTEKHNICHESKOYE STROITEL'STVO, Mar 79) 24

First Turbogenerator Started at Sayano-Shushenskaya Power Plant
(GIDROTEKHNICHESKOYE STROITEL'STVO, Mar 79) 26

FUELS AND RELATED EQUIPMENT

Petroleum, Gas Production Goals for Fourth Year of 10th Five-Year Plan
(GEOLOGIYA NEFTI I GAZA, Mar 79) 32

Classification of Petroleum, Gas Bearing Territories
(G. P. Ovanesov, A. A. Aksenov; GEOLOGIYA NEFTI I GAZA, Mar 79) 42

Analysis of Supercollectors of Orenburg Condensed Gas Deposit
(I. P. Zhabrev, et al.; GEOLOGIYA NEFTI I GAZA, Mar 79) 49

Recent Uzbekistan Oil, Gas Exploration Achievements Told
(M. N. Urumov; GEOLOGIYA NEFTI I GAZA, Nov 78) 60

CONTENTS (Continued)

	Page
Identifying Promising Oil, Gas Fields in North, Siberia Systematized (A. V. Ovcharenko, et al; GEOLOGIYA NEFTI I GAZA, Nov 78)	66

ELECTRIC POWER AND POWER EQUIPMENT

UDC 621.3.016.4:658.562 .061.3

FOURTH ALL-UNION SCIENTIFIC-TECHNICAL CONFERENCE ON ELECTRIC POWER QUALITY

Moscow ELEKTRICHESTVO in Russian, No 3, Mar 79 pp 74-76

[Article by I. V. Zhezhelenko, doctor of technical sciences; conference held 19-21 Sep 78 at Vinnitsa]

[Text] The conference was organized by the Glavniiproyekt of the Electric Power Engineering Institute imeni G. M. Krzhizhanovskiy [ENIN] of the USSR Minerergo [Ministry of Power and Electrification], the Institute of Electrodynamics of the AN Ukrainian SSR, the Ukrainian SSR Minenergo and the PEO [Economic planning department] of the "Vinnitsaenergo," the Vinnitsa Polytechnical Institute, the Ukraine Republic and the Vinnitskaya Oblast NTOE [Scientific and Technical Society of Power Industry] and the EP [Electric transmission].

About 200 representatives of scientific research and planning institutes, scientific research associations and plants, ministries, power systems, city electric networks, higher educational institutions, the USSR Minenergo, the Ukrainian SSR Gosplan, the Ukrainian SSR Academy of Sciences, local party and Soviet organs participated in the work of the conference.

The conference discussed technical, economic, organizational and other aspects of raising the quality of electric power (KE). General and summary reports were heard and there were discussions on the basic questions of the program. Each summary report was made on the basis of published theses of 15 to 20 reports of individual authors and collectives of authors; these reports also formulated the directions of the discussions.

The conference was opened by Ye. A. Karpov, rector of scientific work of the Vinnitskiy Polytechnical Institute, doctor of technical sciences. A. K. Shidlovskiy, corresponding member of the AN Ukrainian SSR, director of the Institute of Electrodynamics of the AN Ukrainian SSR, reported on "National economic and the scientific importance of the problem of electric power quality."

It was noted in the report that about 25% of electric power losses is due to its reduced quality; 80% of the harm done by the poor quality of electric power is due to the technological component. A. K. Shidlovskiy stressed that this harm is of an obscure nature and is not always given the proper attention.

In the opinion of the speaker, further developments require methods for optimizing the indicators of electric quality (PKE), theoretical problems on stabilizing electric network parameters taking into account PKE values, methods for estimating the harm done due to frequency deviation, development of measuring devices and complexes, as well as methods and facilities for improving KE.

B. A. Konstantinov, doctor of technical sciences (Leningrad Engineering-Economic Institute imeni P. Toggliati), in the general report "Effect of electric power quality and the efficiency of its utilization in the national economy" stressed that since the first conference on the KE, held in Moscow in 1961, important successes were achieved in developing the theoretical aspects of the problem, however, practical results in industrial city and rural networks are not shown strongly enough; the electrical industry does not series produce many devices for improving the KE. The speaker called attention to the importance of the joint consideration and solution of problems of the reliability of the electric supply and the KE taking into account the efficient utilization of the electric power. An important factor in raising the KE is increasing the material incentive of the electrotechnical service personnel.

V. V. Mikhaylov, candidate of technical sciences (VNIIPIenergoprom [expansion unknown], Moscow). He noted that according to preliminary estimates the cost of the harm differs from the cost of the facilities for minimizing it by no less than an order of magnitude. An efficient improvement in the KE is possible only by budgeting special money for substantiating to what extent correct methods are to be developed to estimate the national economic harm due to the deterioration of the PKE. V. V. Mikhaylov proposed a discussion of the following problems about the feasibility of introducing a generalized integral estimate of the harm related to low KE and unit harm indicators; the evaluation of the effect of KE on technological processes; methods of reducing loads under emergency conditions.

The discussions on the reports by B. A. Konstantinov and V. V. Mikhaylov noted the necessity of stimulating efficient compensation of reactive power (A. P. Kireyev, NIIkondensatorstroyeniye, Serpukhov), the preparation of manuals for determining PKE values at the design stage, the organization of series production of technical facilities for improving PKE (M. L. Rabinovich, candidate of technical sciences, Kiev branch of the "Ukr. Tyazhpromelektroproyekt").

M. L. Libkind, doctor of technical sciences (ENIN imeni G. M. Krzhizhanovskiy), called attention to the necessity of studying the effect of frequency variation on electric power losses. F. G. Guseynov, doctor of technical sciences (AzNIIelektroenergetika), dedicated his report to the importance of studying voltage fluctuations and the relationship between KE and the reliability of power systems. R. R. Mamoshin, doctor of technical sciences (MIIT) [Moscow Institute of RR Transportation Engineers], spoke of the necessity for developing a method for calculating the harm related to voltage unsymmetry in propulsion networks, as well as about special features of using capacitor banks in RR transport networks. S. I. Marinyak, representative of the PEO "Vinnitsenergo) shared his experience in introducing new equipment, in particular, a hydraulic-accumulator power plant in the power system.

Yu. V. Kopytov (Gosenergonadzor USSR Minenergo) presented a general report "Organizational problems in providing quality electric power in general purpose networks." It was noted that the power systems are doing some work on providing PKE in accordance with GOST 13109-67. In 84 power systems, only the voltage deviations are monitored and in eight -- the values of all PKE; however, PKE monitoring is not done in eight power systems. The basic reason for the weak organization of PKE monitoring is the lack of series production of special devices. The speaker proposed fining consumers who cause deterioration in KE; pay more attention to developing and introducing devices for PKE monitoring; improve training of personnel in methods of PKE monitoring.

S. B. Bello, candidate of technical sciences (Leningrad Cable Network), made a summary report on the same subject. Giving a brief summary of the contents of 19 reports, the theses of which were published, he criticized "Temporary methodological instructions on monitoring KE," which are very difficult to use due to the lack of special devices, the complexity and cumbersomeness of measuring methods, as well as the new edition of "Regulations for utilizing electric power." He noted that the indicated documents do not regulate the material responsibilities of the supplier and consumer for low KE and the allowable amount of substandard power is not defined. He proposed that these problems be discussed, as well as problems of gathering and processing of statistical data on the economic harm, problems of developing PKE projects for existing electric networks and training personnel of technical services in PKE monitoring methods.

L. I. Musnikov (Irkutskenergo), speaking in the discussion, noted the reduction in the reliability of operation of the electric equipment, in particular, of electric motors, under conditions of low KE, as well as the manifestation of considerable errors in recorders in induction systems at nonsinusoidal modes. He proposed the development of a scale of fines and increases for nonobservance of GOST 13109-67 norms.

N. A. Kovtyukh (Training Detachment "Sel'energoproyekt, Kiev), speaking about the problem of voltage regulation in agricultural networks, proposed that they be designed only with transformers equipped with RPN [Load supply relays] ; the RPN switches, according to the speaker, should be placed outside, so that in case of failure of the RPN, the transformer may remain in operation.

M. S. Libkind, doctor of technical sciences, (ENIN imeni G. M. Krzhizhanovskiy), formulated the basic rules for a systematic approach to the problem of improving KE. The systematic approach is applicable, primarily, to solving problems of normalizing the voltage mode at the basic frequency; improvement of other voltage indicators must be provided by local measures and technical facilities. Ye. D. Zeylidzon (Glavtekhupravleniye USSR Minenergo) dwelt on the problem of introducing additional generating capacities for providing the quality of electric power with respect to frequency, as well as the necessity of raising the degree of compensation for reactive power in power systems. The implementation of the latter measure requires an increase in the output of capacitor installations.

Yu. S. Zhelezko, candidate of technical sciences gave a report "Methods for monitoring KE measurements and apparatus." Stressing the fact that the problem received the proper attention in recent years, he noted that the solution to the problem of KE improvement is retarded by the lack of devices for monitoring PKE. The operation of RPN installations and capacitor bank regulators is not always satisfactory. In 1976, the VNIIE [All-Union Scientific Research Institute of Electrical Engineering] jointly with the Latvglavenergo, the Institute of Electrodynamics of AN Ukrainian SSR and the Zhdanovsk Metallurgical Institute developed "Temporary methodological instructions for monitoring KE," which was sent for introduction to 29 power systems. In the opinion of the speaker, an analysis of KE is possible on the basis of statistical data; in this connection, it is necessary to develop a data-measuring system containing a unit for statistical processing of the data. According to the speaker, the basic problems of KE monitoring were opened up for discussion: develop apparatus for monitoring, select monitoring points and establish the durations of measurements.

Ya. D. Barkan, doctor of technical sciences (Latvglavenergo, Riga), summarized 25 reports on the subject "PKE measurements." He called attention to the necessity of making the terminology for KE monitoring more precise and stressed the promising outlook for developing data-measuring complexes and new methods for PKE evaluation based on taking into account the PKE "dose" during an interval of time when characteristic effects of this indicator are demonstrated. In his opinion, the use of magnetic tapes for recording higher harmonics of currents and voltages merit attention. It was suggested that these problems be discussed.

F. A. Zykin, candidate of technical sciences (Ul'yanov Polytechnical Institute), proposed as an evaluation criterion of the nonlinear distortion and stressed that corresponding measuring devices be developed as soon as possible. S. G. Taranov, doctor of technical sciences (Institute of Electrodynamics AN Ukrainian SSR), reported on a data-measuring system for PKE monitoring.. V. V. Neyman (Irkutsk Polytechnical Institute) stressed the importance of the proper choice of the discretization interval and the volume of the sample for the stochastic investigation of PKE in power systems. If the discretization interval is smaller than the correlation interval, the error in PKE evaluation becomes statistically stable in many cases.

A. M. Lipskiy, candidate of technical sciences (Zhdanov Metallurgical Institute), noted that the process of visual perception has power engineering significance, so that it is feasible to determine the permissiblity of voltage fluctuations by the power value of the envelope curve of instantaneous voltage values, i.e., by the "blinking dose." The necessity for creating a methodology for determining harm, due to low KE, and a methodology for PKE measurements was emphaized by V. N. Nikiforova, candidate of technical sciences (VNIIE). In developing such documents, it is necessary to be guided by GOST 8002-71 and the "Single methodological instructions for creating measurement methodology," issued by the Minpribor [Ministry of Instrument Making, Automation Equipment and Control Systems].

E. G. Kurennyy, doctor of technical sciences (Makeyevskiy Engineering-Construction Institute), presented a developed method for modeling a network, taking into account the dynamic properties of electric receivers and some results of using this method. He noted that the inertia of the electric receiver predetermines the possibility of reducing the requirements to the norm values of PKE. A. D. Muzychenko (Institute of Electrodynamics AN Ukrainian SSR) spoke of the necessity of developing methods for making KE measurements, their efficient volume and the creation of a single device for measuring integral values of PKE. In his opinion, in electric circuits with higher harmonics, it is necessary to measure not only effective values of harmonics, but also the effective current values of direct, inverse and zero sequences; this will make it possible to estimate more precisely the harm due to low KE.

M. L. Aberson, candidate of technical sciences (Academy of Municipal Management imeni Pamfilov), spoke on the special features of interrelationships between power marketing and power supply organizations on questions of providing consumers with electric power of the required quality and about the especially developed addendum to the contract on supplying electric power.

V. M. Sorokin, candidate of technical sciences (ENIN imeni G. J. Krzhizhanovskiy), presented a general report "Technical facilities for raising the quality of voltage." He dwelt on methods for providing the required KE for all indicators except frequency. As a basic means for improving KE, the following were considered: higher harmonics filters, balancing devices, reactors with a rotating magnetic field, static sources of reactive power, high-power network stabilizers and voltage regulators. It was shown that due to insufficient utilization of ARPN (Automatic RPN) in 110-500kv networks and the lack of such regulation in 35/10kv transformers, impermissible voltage deviations are observed in 10-0.4kv networks. It was shown that the above-named correcting devices are an efficient means of raising the KE and providing reactive power compensation; the cost of such devices is considerably lower than the cost of rebuilding the electric networks. In conclusion, the speaker described the state of the art of technical facilities for improving the KE in the USSR and abroad (England, Belgium, United States, Japan, Sweden).

A summary report "Technical facilities for raising the quality of power with respect to voltage was made by V. G. Kuznetsov (Institute of Electrodynamics AN Ukrainian SSR). Stating the basic aspects, dedicated to the indicated subject, the speaker called attention to the lack of series produced facilities for improving the KE, delays the solution of the problem considerably, and leads to considerable national economic harm. Developments of individual organizations may serve as the basis for creating series produced technical facilities: controlled reactors with a rotating magnetic field; twin phase stabilizing reactors; controlled reactors with transverse magnetization (ENIN imeni G. M. Krzhizhanovskiy); controlled static compensators (Moscow Power Engineering and Gor'kovskiy Polytechnical institutes); filter-compensating devices (VNIPI "Tyazhproelektroproyekt," Zhdanov Metallurgical Institute, Institute of Electrodynamics AN Ukrainian SSR); filter-balancing devices (Institute of Electrodynamics AN Ukrainian SSR; Omsk Institute of RR Transport Engineers); devices for regulating capacitor banks and RPN transformers and others. V. G. Kuznetsov proposed a discussion on the special features of using multipurpose facilities in electric networks with nonlinear, sharply variable, unbalanced and single-phase loads.

The following participated in the discussion of the problem of creating technical facilities for improving the voltage quality: A. A. Tayts, doctor of technical sciences (Institute of Control Problems), who stressed the need for the wide adoption of static compensating devices which have a number of advantages compared to synchronous compensators. V. A. Kulinich, doctor of technical sciences (Gor'kovskiy Polytechnical Institute) stressed the feasibility of using ferromagnetic devices in electric networks with sharply variable loads, which reduce fluctuations and unbalance of voltages. L. Ya. Bessarabov (Alma-Ata Institute of RR Transport Engineers) formulated requirements for facilities for improving the KE, installed in electrified RR networks. A. A. Ostrovskiy (Donetsk) called attention to the complexity and specifics of introducing technical devices in explosive and fire hazardous mines. V. R. Mamoshin, doctor of technical sciences (MIIT), pointed out the specific features of compensating for reactive power in electric propulsion networks. V. S. Ivanov, candidate of technical sciences (VNIPI "Tyazhpromelektroproyekt")spoke on the special features of reducing the nonsinusoidal characteristics and voltage fluctuations in electric networks which have reducing rolling mills.

I. V. Zhezhelenko, doctor of technical sciences (Zhdanov Metallurgical Plant), made a general report on "Optimal methods and criteria for raising the quality of electric power." He summarized the problems for raising the KE and formulated conditions on which it is possible to consider these problems as optimal. On the basis of a functional analysis of the economic harm, he concluded that the problem of voltage regulation is the most important one, including in the range of allowable values of voltage deviations. The problems of reducing the nonsinusoidality, unbalance and voltage fluctuations are frequently found to be technical, and the values of the corresponding KE indicators must be reduced to the allowable limits on the basis of technical considerations. Similarly, in designing technical facilities for improving the KE, there is no need for optimizing solutions in all cases; it is necessary to take into account the recommendations incorporated in calculation and design practice which are the result of previously solved optimization problems. He stressed the urgent need for series produced facilities for improving the KE.

V. G. Avvakumov, candidate of technical sciences (Vinnitsa Polytechnical Institute), made the summary report "Optimization of electric power quality." He noted that all reports on the considered problem may be classified in several groups: dedicated to the choice of optimal facilities for improving the KE; the determination of their optimal parameters, as well as optimization of individual PKE or of their complex; methods of single-purpose and multipurpose optimization. It was pointed out that from the mathematical viewpoint, the problems of selecting the optimal parameters of facilities for improving KE and KE indicators are, in most cases, problems of single or multiple-parameteric nonlinear programming.

Basically, the methodological questions for raising the KE were touched upon in the general discussion. G. L. Bagiyev, candidate of technical sciences (Leningrad Engineering-Economic Institute imeni P. Toggliate), proposed a refinement of the terminology in the KE area. Yu. V. Slepov (Zhdanov Metallurgical Plant) expressed the thought that it is not feasible to create an ASU [Automatic control system] KE. This viewpoint was supported by A. F. Seredenko (Minergo Ukrainian SSR). V. M. Bozhko (Kiev branch of "Ukr. Tyazhpromelektroproyekt" Institute) spoke on the necessity of organizing series production of facilities for improving KE. Yu. N. Berlinskiy ("Soyuztekhenergo" Production Association talked about the creation of a Coordinating Council of the Problem of the Comprehensive Control of Electric Power Quality at the USSR Minenergo.

The draft of the resolution was presented by M. S. Libkind, doctor of technical sciences (ENIN imeni G. M. Krzhizhanovskiy). The resolution unanimously adopted, stated that the most rapid solution of the problem of raising the quality of electric power requires capital investments in creating power reserves in the power systems and in developing electric networks. The conference requested the USSR Minpribor to develop measuring devices for monitoring the PKE and to organize their series production, and asked the USSR Minenergo and Minelektrotekhprom [Ministry of Electrical Equipment Industry] to consider the requirement in power engineering of 35kv transformers with RPN, synchronous compensators, controlled capacitor banks, controlled reactors and other types of equipment for improving the KE.

The development of the following was recommended: industrial standards for PKE monitoring methods; methodological manuals for power marketing personnel on PKE monitoring; industrial standards for allowable PKE values at separation points between networks and at feed centers; a regulation on bonus payments and other forms of incentive to the PES [Peak-load electric power plant] personnel, personnel servicing electric installations of consumers, and for maintaining the PKE within norms; an addendum to the existing "Regulations for using electric and thermal power" for the purpose of taking into account the requirements for normalizing the KE.

The recommendations of the conference stress the paramount importance of implementing practical measures directed toward the solution of the KE problem. Also, noted is the necessity for continuing further scientific research work on the basic aspects of the problem.

2291
CSO: 1822

ELECTRIC POWER AND POWER EQUIPMENT

UDC 621.315.1.001.2:621.315.17

WAYS FOR RAISING CONSTRUCTION EFFICIENCY OF 750KV OVERHEAD LINES

Moscow ENERGETICHESKOYE STROITEL'STVO in Russian No 12, 1978 pp 8-14

[Article by engineer I. M. Shapiro]

[Text] Further development of the Single Power System of the USSR -- is one of the main factors in raising the efficiency of electrical power engineering and the quality of supplying electricity to the national economy of the country. Of special importance in this is the building of electric power transmission lines of superhigh voltage and, in particular, with voltages of 750kv. In the 10th Five-Year Plan period alone, the length of 75kv lines will increase by over 1000km. In this connection, the problem of standardization and typicalization of the technical solutions adopted for these lines is urgent.

Since by now projects for 12VL (Overhead line) with a total length of 3587km have already been completed and the volumes of lines of this class being put in operation will undoubtedly increase, the author, taking into account the accumulated experience and construction performed an analysis of the technical-economic indicators of VL 750kv.*

The need for such an analysis was also confirmed by the fact that until now, a practically individual project was being prepared for each VL750kv line. It should be noted that the Konakovo-Moscow experimental electrical power transmission line was excluded from this analysis because several solutions adopted in the project were of an experimental nature and, therefore, could not be utilized for technical-economic analysis. The Donbass-Western Ukraine line was considered as three VL, the projects for which were made in different years. The VL750kv Chernobyl'skaya AES-Western Ukraine Substation (557km) consists of two sections with various transit capacities and with different technical-economic indicators. Since, however, all necessary data in a technical project (material consumption,

* The first such analysis for fine VL750kv lines was made in 1974 by ODP [Department of Long Transmission Lines] of the Energoset'proyekt Institute

estimated cost, etc.) were not separated by sections, this VL was considered as a single one with as much as possible individual analyses of certain indicators for the first (Chernobyl'skaya AES-Khmel'nitskaya AES, 331km long) and second (Khmel'nitskaya AES-Western Ukraine Substation, 225km) sections.

The technical-economic indicators of the VL750kv lines considered are shown in Table 1 (in the following, instead of the VL name, its number according to Table 1 will be given).

VL routes and climatic conditions. The lengthening of routes compared to the aerial straight lines varied from 2.3% to 42%. If the two extreme values are excluded (for short VL Nos 3 and 5, passing respectively through extremely favorable and unfavorable conditions), the average value of route lengthening is 10%, which is considerably lower than the norm for VL35-750kv in various regions of the country (from 16 to 26%). This attests to a fairly strict approach to the choosing and coordinating of VL 750kv lines.

The number of turning angles per route km varies from 0.1 to 0.3 (average of less than 0.2), with the exception of VL No 9, half of which passes through mountains. The indicator considered for this line is close to 0.5 and is comparable to the average norm of VL500kv (0.4).

Norms for the wall thickness of the glaze of ice and wind pressure velocity assumed for designing VL750kv lines are shown in Table 2.

As follows from data in Table 2, most VL750 lines pass through II-III regions with respect to icing up. In this case, 24% of the total length of VL pass through region IV with respect to icing up (these are territories of the Ukrainian and Moldvian SSR). VL routes Nos 1 and 4 pass through the best climate conditions and Nos 9 and 12 -- through the worst ones.

Rated power flows, wire cross sections and phase structure. The determination of rated power flows for VL750kv lines have certain complications [1], since a considerable part of the components of these flows are of a problematic nature. Frequently, the balance overcurrents (most authentical values) makes up an insignificant part of the rated transit capacity of the VL[2]. Thus, the authenticity of the rated flows assumed in the projects may be checked only during a fairly long period of operation.

The VL750kv lines considered may be divided into two groups from the standpoint of determining rated power flows. VL, designed for distributing the output of electric power plants or for stable, with respect to time, power transmission (for example, export of electric power), -- for them balance flows (VL Nos 1, 2, 3, 5, 9, 10, 11 (2), 12) are basic and inter-system VL, designed for power exchange between systems (the change in value and current direction in these depend on many factors).

The conductor cross section for all VL750kv lines was selected on the basis of individual technical-economic calculations in each project. From 3 to 15 versions of structure and cross section of phase were considered. The choice of the optimal conductor cross section for VL750kv lines is related to the selection of the phase structure (number of conductors, distance between them) and the distance between phases. Moreover, corona electric power losses have considerable effect on the calculation results, therefore, for VL750kv lines, the method of selecting an efficient cross section with respect to the norm for an efficient current density, used for VL35-500kv lines is unacceptable (it should be noted that this method does not give optimal results also for VL35-500kv lines).

The choice of a cross section for the majority of electric power transmission lines was made by the method shown in [2, 3] . Exceptions are VL Nos 4 and 5 whose designers (the SZO [Northwestern branch] of the Energoset'-proyekt) consider it possible to apply for a VL750kv line a norm of efficient current density utilized for the VL35-500kv line [4] . However, in this case, factors were not considered such as the dependence of the variable component of the cost of the VL750kv line on the phase structure, effect of corona losses, and the effect of the costs of compensating installations and reactors.

In design practice of VL750kv lines abroad, designs with four conductors per phase with a total cross section of 1840mm^2 (United States) and 2760mm^2 (Canada) are used. Current density for the VL is from 0.5a/mm^2 (Canada) to 1a/mm^2 (United States) [5] .

There are two phase structures in the USSR:

with four conductors per phase and a 60cm splitting pitch (eight VL, 58% of total length);

with four conductors per phase and a 30 to 40cm splitting pitch (five VL, 42% of total length).

The use of a phase structure, split into five conductors, makes it possible to utilize smaller diameter conductors, while still observing permissible conditions of corona voltage on the surface, i.e., the total cross section of the phase can be smaller than when split into four conductors. However, the line hardware and the installation work become more complicated.

A comparison between the structure and cross section of phases and the assumed rated power flows did not permit the detection of any pattern: different designers assumed various structures and cross sections of phases for VL with about the same power flows and passing practically through the same conditions. Six versions of phase cross sections were assumed for 13 VL.

The current density, assumed to be an efficient one, for each VL varied within very wide limits in spite of about the same flows. A more extensive analysis is required for finding the reasons for these variations. However, on a preliminary basis the following should be noted:

in projects Nos 4 and 5, the cross section was selected on the basis of the norm for efficient current density of VL35-500kv lines (the current density if highest for these VL);

in technical-economic papers (of concrete) projects various initial data were assumed (in particular, cost of building VL with various phase structures);

calculations were made at various times.

On the basis of an analysis of the cited data, the following is recommended:

for power flows of 1100 to 1500 megawatt phases of five AS-300/66, conductors should be used (current density 0.6 to 0.8 a/mm^2); for power flows of 1500 to 2100 Mw phases of four AS-500/64, conductors should be used (current density the same).

Lightning protection cables. On the majority of VL (74% of the total length), the design specifies the suspension of two nonsplit cables; on three (21%) -- two split cables; on one VL (5%) -- split and nonsplit cables.

Lightning protection cables on all VL are utilized for high-frequency communications, therefore, the designs specify a steel-aluminum conductor with a higher steel content (AS-70/72).

Only in VL Nos 9 and 11, on route sections passing through region IV with icing conditions, is conductor AS-95/141 used because of the necessity to maintain a vertical distance between the conductor and cable to prevent contact between them because of whipping. At the same time, in project VL No 12, it was shown that this condition need not be strictly observed.

It should also be noted that the use of an AS-95/141 conductor instead of the AS-70/72 leads to a higher cost of about 1000 rubles per km of VL750kv line.

Insulation. Routes in the already built VL750kv lines pass through various conditions from the viewpoint of air pollution, which predetermined different lengths of leakage paths when selecting insulation: for most VL (70% of length) 1.5 - 1.1 cm/kv is assumed; for 22% -- 1.3cm/kv and only for 8% -- 1.7 - 1.78 cm/kv (for VL USSR-NRB that passes through saline soils and also for small sections of other Vl, passing near industrial enterprises).

Table 1 (left half)

(1) Технико-экономические показатели	(47) Линия электропередачи				
	(42) Калининская ГРЭС — подстанция Юго-Западная (1)	(43) Курск — Брянск (2)	(44) Смоленская ГРЭС — Брянск (3)	(45) Ленинград — Москва (4)	(46) Ленинградская АЭС — Ленинград (5)
(2) Характеристика трассы:					
протяженность, км (3)	318,9	207	131	526,1	124
(4) удлинение по сравнению с воздушной прямой, %	3	7,8	2,3	10	42
(5) количество углов поворота	31	44	22	59	40
то же на 1 км (6)	0,097	0,212	0,168	0,112	0,322
(7) Конструкция фазы	5×АС-330/27	5×АС-240/56	4×АС-500/64	5×АС-240/56	5×АС-300/30
Плотность тока, А/мм² (8)	0,61	0,81	0,85	1	0,95
(9) Шаг расщепления фазы, см	40 (37)	30	60	30	30
(10) Количество, марка и сечение тросов	2×2 АС-70/72	2×2 АС-70/72	2×2 АС-70/72	2 АС-70/72	2 АС-70/72
(11) Основной тип промежуточной опоры	П750-2 (38)	П750-1	П750-1С	(41) „Набла"	„Набла"
(12) Расстояние между фазами, м	16,6	18,5	18,5	19,5	13,5
(13) Высота подвески провода, м	35	35	35	38	38
(14) Масса, т	10,7	12	12,48	12,9	11,25
Количество типоразмеров опор (15)	4	5	4	2	2
(16) Количество опор П/АУ, шт./км	2,27/0,1	2,23/0,135	2,17/0,14	2,05/0,132	1,72/0,43
(17) Коэффициент использования расчетного пролета	0,93	0,93	0,9	0,88	0,87
(18) Длина пути утечки, см/кВ	1,5; 1,5	1,5	1,5	1,3	1,3
(19) Количество и тип изоляторов в гирляндах:					
(20) поддерживающих	32—35; ПС22А (39)	34; ПС22А	34; ПС22А	2×37; ПС12А	2×38; ПС12А
(21) натяжных	5×40÷44; ПСШ2А (40)	5×38; ПС16Б	4×36; ПС22А	5×37; ПС12А	5×39; ПС12А
(22) Расход основных материалов, т/км:					
металла для опор (23)	30,64	34,8	35,37	29,7	36,1
(24) проводов	16,59	17,05	22,9	17,2	17,7
тросов (25)	3,02	3,28	3,26	1,66	1,57
(26) Расход железобетона для фундаментов, м³/км	20,37	21,4	22,63	14,9	23,1
(27) Стоимость строительства, тыс. руб./км: (28)					
(29) по сводной смете	68,5	67,6	79,5	66,4	71,2
(30) в том числе строительно-монтажных работ	52	50.45	58,2	52,3	58,7
(31) по второй главе сводной сметы	47,5	47,3	53,7	46,8	51,1
(32) в том числе строительно-монтажных работ	39,5	39,9	45,9	40,5	43,6
(33) Удельные показатели:					
капиталовложения, (34) руб./(кВт·км)	0,053	0,053	0,037	0,043	0,038
(35) расход металла на опору, кг/(км·мм²)	18,8	28,9	18	24,6	24

(36) * В числителе приведены данные для участка Чернобыльская АЭС — Хмельницкая АЭС, в знаменателе — для участка Хмельницкая АЭС — для III района). ** в скобках дан объем монолитного железобетона.

напряжением 750 кВ (номер ВЛ) (47)

Table 1 (right half)

(48) Донбасс — Днепр (6)	(49) Днепр — Винница (7)	(50) Винница — подстанция Западноукраинская (8)	(51) Подстанция Западноукраинская — Альбертирша (9)	(52) Курск — Металлургическая (10)	(53) Чернобыльская АЭС — подстанция Западноукраинская (11)	(54) СССР — НРБ; участок Молдавская ГРЭС — государственная граница (12)
334,2	416,7	360,6	211	189,5	331*/226	210,5
11,4 73 0,219	4 80 0,192	14,4 65 0,18	12,2 103 0,488	8,7 25 0,132	16,3 104 0,187	9,6 38 0,18
4×AC-400/93	4×AC-400/93	4×AC-400/93	4×AC-400/93	4×AC-500/64	5×300,66 4×500/64*	4×AC-500/64
0,57 60	0,67 60	0,47 60	0,78 60	0,67 60	0,4/0,74* 30/60*	0,81 60
2 AC-70/72	2 AC-70/72	2 AC-70/72	2 AC-70/72 2×AC-95/141*	1+2 AC-70/72	2 AC-70/72 2 AC-95/141*	2 AC-70/72
(55) ПО 19,5 32	ПО 19,5 32	ПО 19,5 32	ПО 19,5 35 (32 для горных участков)	ПО 16,5 35	ПО 16,5 35	ПО 16,5 35
16,53 4 2,54/0,222	16,53 4 2,59/0,199	13,93 6 2,54/0,225	14,5 8 2,2/0,69	(56) 13,07 3 2,3/0,164	13,07/13,9** 3/3* 2,17/0,267	13,2 3 2,4/0,223
0,89 1,6; 1,8 (16 км)	0,9 1,6	0,82 1,6	0,87 1,5; 1,8 (15 км)	0,9 1,5	0,87 1,5	0,9 1,7 (55 км); 1,8—2 (155 км)
2×44-49; ПС12А	2×44; ПС12А	2×44; ПС12А	2×44; ПС12А	2×44; ПС12А	2×44; ПС12А 1×35 ПС210Б*	2×40÷47; ПСГ12А (57)
4×34÷41; ПС22А	4×34; ПС22А	4×34; ПС22А	4×34; ПС22А	4×36; ПС22А	5×37; ПС210Б 4×37 ПС30Б*	4×42÷48; ПС210Б
53,7 23 1,66	51,32 23 1,66	44,94 22,8 1,66	67,6 22,9 2,27	38,28 22,9 2,33	41,2 21,35 1,82	43,6 22,9 1,56
28,35	25,33	26,65	19(49)***	22,43	38,4	30,2(5)
78,9	72,3	74,6	111	71,02	77,65	77,6
— 64,4	— 60,5	61,93 60,9	88 91	53,58 51,06	61 56,42	58,6 57,8
50,5	49,1	49,4	74,4	43,92	49,2	43,5
0,06	0,06	0,075	0,068	0,042	0,064	0,038
33	32	27,7	41,6	19,5	25	22,2

подстанция Западноукраинская; ** в числителе для II—III районов по гололеду, в знаменателе — для IV (по ВЛ № 1) в числителе только

Key to Table 1 on previous sheets:

1. Technical-economic indicators
2. Route characteristics
3. length, km
4. Increase in length compared to straight air line, %
5. Number of turning angles
6. Same per km
7. Phase structure
8. Current density, a/mm^2
9. Splitting pitch of phase, cm
10. Number, brand and cross section of cable
11. Basic type of intermediate pole
12. Distance between phases, m
13. Height of conductor suspension, m
14. Weight, tons
15. Number of type-sizes of poles
16. Number of P/AU poles, piece/km
17. Utilization coefficient of rated span
18. Length of leakage path, cm/kv
19. Number and type of insulators in chain
20. supporting
21. under tension
22. Consumption of basic materials, ton/km
23. metal for poles
24. conductors
25. cables
26. Consumption of reinforced concrete for foundations, m^3/km
27. Cost of construction
28. thousands of rubles/km
29. according to consolidated estimate
30. including construction-installation work
31. According to second chapter of consolidated estimate
32. Including construction-installation work
33. Unit indicators
34. Capital investment, rubles/kv.km
35. Metal consumption per pole, kg/(km.m^2)
36. *In numerator is shown data for the Chernobyl'skaya AES - Khmel'nitskaya AES section, in denominator - for the Khmel'nitskaya AES-Western Ukraine Substation section. ** In numerator for II-III region according to icing, in denominator -- for IV (according to VL No 11 in numerator only for III regions); *** in brackets is given volume of monolithic reinforced concrete.
37. AS-70/72
38. 8750-2
39. PS22A
40. PSSh2A
41. "Nabla"
42. Kalininskaya GRES - South - Western Substation (1)
43. Kursk-Bryansk (2)
44. Smolenskaya GRES - Bryansk (3)
45. Leningrad-Moscow (4)
46. Leningradskaya AES - Leningrad
47. Electric power transmission line 750kv (VL number)
48. Donbass-Dnepr (6)
49. Dnepr-Vinnitsa (7)
50. Vinnitsa-Western Ukraine Substation (8)
51. Western Ukraine Substation - Al'bertirsha (9)
52. Kursk-Metallurgicheskaya (10)
53. Chernobyl'skaya AES - Western Ukraine Substation (11)
54. USSR-NRB: Moldavskaya GRES - border (12)
55. PO
56. for mountainous sections
57. PSG12A

Table 2

(1) Характеристика	(4) Протяженность линий электропередачи	
	км	% (от общей)
(2) Толщина стенки гололеда, мм:	(5)	(6)
10	1298,4	36,1
15	1415,3	39,5
20	857,7	24
25	15	0,4
(3) Скоростной напор ветра, Н/м²:		
550	2184,5	61
650	1282,5	35,7
760	120	3,3

1. Characteristic
2. Wall thickness of ice, mm
3. Wind velocity pressure, Newton/m^2
4. Electric power transmission line length
5. km
6. % of total

Table 3

(1) Количество проводов в фазе	(2) Марка провода	(3) Сечение провода, мм²	(4) Количество запроектированных ВЛ	Номер ВЛ (см. табл. 1)	(5) Протяженность, км (% общей протяженности)	(6) Плотность тока, А/мм²
5	240/56	1205	2	2, 4	733,1 (20,4)	0,81—1
	300/39	1505	1	5	124 (3,5)	0,95
	300/66	1440	1	11 (1)	331 (9,2)	0,4
	330/27	1625	1	1	319 (8,9)	0,61
4	400/93	1624	4	6, 7, 8, 9	1322,5 (36,9)	0,47—0,78
	500/64	1960	4	3, 10, 11 (2), 12	757 (21,1)	0,67—0,85

1. Number of wires in phase
2. Conductor brand
3. Cross section of conductor, mm^2
4. Number of designed VL
5. Length, km (% of total)
6. Current density, a/mm^2

Nine VL (75% of length) were designed with two-string supporting chains and PS12-A insulators (for VL No 12 -- PSG12-A, dirt resistant). This solution was adopted because, according to calculations, the cost of two-string chains was lower and the length shorter per meter than single-string chains with PS22-A insulators and, besides, they were more reliable in operation. At the same time, the use of two-string chains leads to complications in line hardware and an increase in the number of insulators. The adoption of new type PS210B insulators with a greater ratio of leakage path length to the insulator height (2.25 instead of 1.95 for PS22-A) and the change in market price conditions make it possible to recommend the use of single-string chains as more economical. Thus, for a leakage path length of 1.5cm/kv the lengths of a single-string 1 x 35-PS210B chain and a two-string 2 x 44-PS12-A chain are almost the same, while the cost of the first is only about 2/3 the cost of the second. Moreover, high quality insulators (rejection 0.1 to 0.3% per year) raise the reliability of the single-link chains, as confirmed by experience in operating VL500kv lines.

The recommendations cited may be utilized for VL that pass through the II-III regions with respect to icing for a leakage path length of 1.5cm/kv.

The solutions adopted for chains under tension in all projects are identical: the number of strings in a chain correspond to the number of conductors per phase, while the types of insulators were determined on the basis of mechanical strength. Depending upon the RKU [expansion unknown] and brand of the conductor, insulators from PS12 to PS30B are used.

It follows from the above that for the majority of VL, it is feasible to use single-string chains as supporting and multi-string chains as tensioning chains with the number of chains equal to the number of conductors per phase; as operating experience is accumulated, it is necessary to make the insulation levels more precise for VL of this voltage class for various conditions of contamination.

Poles and foundations. All electric power transmission lines use metal, zinc-plated bolted poles. The basic question in developing the pole design is selecting the design of an intermediate pole.

In the majority of the designed VL (2937km or 82% of total length), portal poles with two pairs of guys (PO) are used. The optimum height to the corssarm is 35m (at the first industrial Donbass-Western Ukraine VL, a height of 32m was adopted). The distance between phases varies between 16.5 and 19.5m depending upon the adopted phase structure and insulation. The multiplicity of initial conditions (phase structure, RKU) dictated the design differences and the varying weights of the poles (from 10.7 to 16.5 tons; the higher value applies to the first VL750kv line, the lower -- to one of the recent lines), in spite of the same geometrical arrangement.

At present, the Department of Long Transmission Lines developed a new design of a portal pole with guys which differ from the ones used earlier by having a greater slope in the cable rack (4:1 instead of 10:1) and the installation of a so-called "broken" crossarm. On the basis of data of available developments (VL No 2, II-III regions with respect to icing, phase 5 x AS-240), this pole is more economical than the one used previously.

On two electric power transmission lines (total length 650km), a V-shaped pole is used with four pairs of guys ("Nabla"); the height to the crossarm is 38m, the distance between phases is from 19.5 to 13.5m (the latter value refers to a modernized pole with a "broken" crossarm. A somewhat lower weight and a larger span (520 to 535/475m in regions II-III with respect to icing instead of 502/452m for the portal) predetermined its use on VL No 4. The shortcoming of this pole is the complexity of the installation itself and of the middle phase of the conductors. Moreover, such a pole requires greater ground area for its use.

An analysis of technical-economic indicators of poles of these types was made previously [4, 6-10] . It was acknowledged that the use of the "Nabla" pole is justified for individual VL whose routes are characterized by flat terrain (where a higher span can be used) or which pass through marshy, wooded land (where the area removed from useful usage is not of decisive importance). It should be added that in region IV with respect to icing the rated span for the "Nabla" span cannot be used independently of the shape of the terrain because of the conditions of the insulation strength. Thus, for VL No 2, the rated span for the "Nabla" pole is 460m. However, according to insulation strength conditions (a doubled chain of PSG12A), it must be limited to 420m (the use of heavier PS16B insulators is inefficient: the allowable span increases to 437m, but the cost of insulators increases sharply). This fact reduces the efficiency of using the "Nabla" pole (for VL No 12 the saving in metal is about 5%, but an increase in land area taken for this purpose -- a considerable part of which is good agricultural land, leads to an increase of 7% in the cost of the VL).

It should also be noted that up to now the "Nabla" pole was compared to the portal pole of the old design. If the "Nabla" pole is compared to the portal pole of the new design, (a pole with a "broken" crossarm," it is obvious that the new design is more economical also in metal consumption (for VL No 1 the weight of the П- shaped pole is 10.7 tons and for VL No 5 the weight of the "Nabla" pole is 11.25 tons).

Besides the considered poles, the project plans specify the use of intermediate free-standing poles. Their use is feasible in bottom lands of rivers, in passes and under other special conditions. The poles represent portals 35 to 40m high (5m pedestal).

Three-support poles are used in all projects as angle-anchors. The difference between them is in the adopted height of the suspension point of the conductor (20, 25, 30, 40m -- VL No 4, 5; 20; 25; 30m -- VL No 6, 12; 16, 24, 32m -- VL No 1 to 3) and the method of bypassing the loops (by guying to the adjacent support, using rigid loops and the combination method: two phases according to the first method and one -- according to the second).

In a considerable part of the projects, there is also specified the installation of intermediate-angular poles for a turning angle of the route from 10 to 20°. The use of these poles permits the reduction in metal consumption, however, this also leads to a considerable complication in installing the conductors. It appears feasible to consider the problem of developing economical angle-anchoring poles with a turning angle of up to 20° instead of the intermediate-angular ones.

The VL already designed use from two to six type-sizes of poles (without taking into account mountainous VL No 9). The use of 3-4 basic type-sizes of poles should be considered optimal.

The number of angle-anchoring poles per km depends on the conditions of the route and varies from 0.1 to 0.43 (without taking into account the mountainous VL No 9). The number of intermediate poles per km of lines varies from 2.05 for a 30m height of conductor suspension to 2.59 for a height of 32m; for a height of 35m, these values vary from 2.17 to 2.4m. The utilization coefficient of a rated span varies between 0.82 to 0.93 and on the average is equal to 0.885 (for VL500kv line the average coefficient is 0.91).

Standard reinforced concrete pedestals (under supports) and anchor plates (for guys) are used as foundations in all VL. In individual cases, at especially unfavorable ground conditions, piling foundations are used (for intermediate free-standing poles).

Thus, in designing standardized poles for VL750kv lines, it is necessary to:

adopt a portal type of pole with guys as a typical intermediate pole;

develop a design for a loop bypass angle-anchor poles without using rigid loops that have a number of shortcomings;

consider the feasibility of using angular-anchor poles with an up to 20° turning angle instead of an intermediate-angular pole;

use no more than four type-sizes of poles.

Material consumption. Conductor consumption per km of VL depends on the selected phase structure (see Table 1) and varies from 17 to 23 tons.

In connection with the use, at the majority of VL of the AS-70/72 conductor as a light-protection cable), its consumption is determined only by the number of cables (2, 3, or 4) which, in its turn, depends on the communications circuit adopted.

The unit metal consumption for poles depends on so many conditions (the adopted phase structure, the RKU, the number of turning angles, the type of the basic, intermediate pole and the height of the crossarm), that it is impossible to make a precise comparative analysis of indicators (see Table 1). To exclude the effect of the adopted phase cross section, it is feasible to introduce an additional indicator -- metal consumption per km of the VL and per mm^2 of phase cross section [in kg ($km.mm^2$)] (smaller values, as a rule, are referred to VL with a greater phase cross section):

"Nabla" -- 24-25;

PO (32m) -- 28-33;

PO (35m) -- 20-25 (without taking into account the mountainous VL);

same with "broken" crossarm -- 18-19 (besides VL No 2).

Thus, the most efficient material for poles is used in intermediate poles with guys with 35m high crossarms.

The unit consumption of prefabricated reinforced concrete for foundations is changed insignificantly depending upon the conditions of laying the route and ground conditions. For lines with "Nabla" type poles, the unit consumption of reinforced concrete is less than average, however, in this case, it is necessary to take into account the metal consumption for building foundations.

Construction cost. Cost analysis of VL750kv lines already built is, to a considerable extent, of a preliminary nature since a single approach when separating the construction cost from the total estimated cost of the VL750kv line itself is impossible. Moreover, it is necessary to take into account different conditions for building the VL, its transit capacity (therefore, the phase cross section and structure), climatic and terrain conditions, the number of crossings, etc. Nevertheless, the VL750kv line cost indicators cited in Table 4 are of interest.

Table 4

(1) Показатель	(9) Количество линий электропередачи		
	4	3	3
(2) Сечение и конструкция фазы	5×АС-240, 300, 330	4×АС-400	(10) 4×АС-500
(3) Район по гололеду	II—III	III—IV	(11) III—IV (частично II)
(4) Стоимость сооружения 1 км ВЛ, тыс. руб.:			
(5) минимальная	66,4	72,3	71
(6) максимальная	71,2	78,9	79,5
(7) Удельный вес затрат по 2-й главе сводной сметы, %	70—72	82—83	68—75

(8) Примечание. В таблицу не включены данные по горной ВЛ № 9 и ВЛ № 11, состоящей из двух участков с подвеской проводов разных сечений.

1. Indicator
2. Phase cross section and structure
3. Icing regions
4. Construction cost per km of VL, 1000 rubles
5. minimal
6. maximal
7. Unit cost according to second chapter of consolidated estimate
8. Note. We included data in the Table for mountainous VL No 9 and for VL No 12 consisting of two sections with conductors of various cross sections
9. Number of transmission lines
10. AS-500
11. (partial II)

Attention should be given to the considerable cost ratios that do not enter the second chapter of the consolidated estimate. In particular, the increase in the cost ratio of land taken up by the poles is characterized by the following data: VL No 6 -- 3.7%; VL No 7 -- 2.6; VL No 11 -- 5.9; VL No 12 -- 8.8%. It should be noted that in the VL No 12 design, a constant assignment of ground was made separately for each support and guy, unlike other VL, where (like VL500kv line), the site assignment was made for the entire pole (otherwise the cost ratio of land would have been 12.5%).

To exclude the effect of transit capacity of VL on cost indicators, it is feasible to introduce an additional indicator -- unit capital investments per kw of transmitted power per km of line (Table 1).

Conclusions

1. Design experience makes it possible to change over to the standardization of design solutions and to use typical structures in order to reduce considerably labor expenditures on building VL750kv lines.

2. Phase cross sections and structures must be limited to two types: for VL with power flows of 1100-1500 Mw, 5 x AS-300/66; 1500-2100 Mw -- 4 x AS-500/64.

3. It is expedient to standardize poles used in VL750kv lines, taking the following into account:

poles must be developed for two phase structures and for region III icing conditions where it is planned to do the basic volume of construction of VL750kv lines, expanding the area of their application to regions II and IV;

a portal with guys should be adopted as the basic intermediate pole (the version with the higher slope of the supports and a "broken" crossarm);

no more than four type-sizes of poles should be used.

4. It is feasible to develop typical chain insulators for the two adopted phase structures.

BIBLIOGRAPHY

1. Yershevich, V. V.; Lapitskiy, Yu. S.; Neyman, V. A. "Effectiveness of Introducing a 750kv Voltage in the Consolidated Power System of the South." In handbook "Long-Distance 750kv Power Transmission Lines." General editors A. M. Nekrasov and S. S. Rokotyan. Part 1. "Aerial Lines." Moscow, Energiya, 1974, pp 21-25.

2. Illarionov, G. A. "On Selecting Economical Cross Sections of 750kv Electric Power Transmission Lines," ibid., pp 64-68.

3. Bratslavskiy, S. Kh.; Gershengorn, A. I.; Lyskov, Yu. I. "Phase Structure Selection for 750kv Lines," ibid., pp 84-91.

4. Kryukov, K. P.; Nosov, I. M.; Fel'dman, M. L. "Basic Design Solutions for the 750kv Konakovo-Leningrad Electric Power Transmission Line," ibid., pp 176-183.

5. Mel'nikov, N. A.; Rokotyan, S. S.; Sherentsis, A. N. "Design of the Electrical Part of 330-500kv Aerial Lines for Electric Power Transmission." Energiya, 1974, pp 31-49.

6. Zelichenko, A. S.; Lyalin, F. I.; Shlyapin, I. A. "Design of 750kv Aerial Lines for Electric Power Transmission," ibid., pp 157-169.

7. Gendel'man, Ye. A.; Levin, L. E.; Maydanik, A. N.; Tikhanova, O. P. "Construction Part of 750kv Electric Power Transmission Lines of the Consolidated Power System of the South," ibid., pp 170-174.

8. Pogrebkov, K. A. "Construction of the Konokovo-Leningrad 750kv Electric Power Transmission Line." ENERGETICHESKOYE STROITEL'STVO, No 6, 1976 pp 50-53.

9. Peterson, L. L.; Kryukov, K. P. "750kv Leningrad-Moscow Electric Power Transmission Line." ELEKTRICHESKIYE STANTSII, No 6, 1975, pp 32-37.

10. Kolyakov, I. M.; Shlyapin, I. A. "Concerning Article by L. L. Peterson and K. P. Kryukov." ELEKTRICHESKIYE STANTSII, No 2, 1977 pp 89-91.

2291
CSO: 1822

ELECTRIC POWER AND POWER EQUIPMENT

BRIEF NOTES ON CONSTRUCTION STARTS AND ACCOMPLISHMENTS

Moscow GIDROTEKHNICHESKOYE STROITEL'STVO in Russian No 3, Mar 79 pp 35-36

/Article: "Chronicle of Construction and Operation"/

/Text/ A triumphal gathering dedicated to Power Day took place on December 22nd. In the presidium were member of the CC CPSU Politburo, CC CPSU secretary A. P. Kirilenko, assistants to the USSR Council of Ministers chairman V. E. Dymshits and I. T. Novikov, director of the CC CPSU Division of Machine Building F. S. Frolov, directors of ministries and departments and leaders of socialist competition. The first unit of the Sayano-Shushenskaya GES /hydroelectric power plant/ had been placed under industrial load ahead of schedule. This is one of labor's gifts by which they celebrated our trade holiday for the Country's power, successfully bringing to life the resolutions of the November (1978) Plenum of the CPSU Central Committee. Workers of the sector certified that all efforts would be applied to implementing the five-year plan quotas successfully.

The LEP /electrical transmission line/ 500 of the Toktogul'skaya GES was placed under load on the eve of 1979. A variety of original technical solutions were used in constructing the unique electrical transmission line which steps across the Tyan'-Shan'.

The LEP 500 construction was carried out under challenging conditions. Installers of the Spetsset'stroy trust surmounted steep mountain slopes, canyons and avalanches and installed poles at an altitude of more than 3000 meters. Aviators assisted the installers in conquering the passes. The electrical current of the Toktogul'skaya GES will be received by the new Fruzenskaya substation constructed in the vicinity of the suburb Chaldover. Not only will the reliability of the power supply to a number of regions of Kirgizia be increased with its incorporation but also the power supply to Kazakhstan and other republics.

Installation of the first unit has begun at the Nizhnekamskaya GES It has been decided to put it into operation in the first quarter of 1979. Electrical installation, construction, concrete and finish work is going at full speed.

In the Ust'-Ilimskaya GES construction project, installation of the 16th hydraulic turbogenerator with 240,000 kilowatts of power was begun in the first days of January of this year. The builders planned to place this unit under industrial load in March of this year. It is planned to put two more units into operation here by the end of the five-year plan and to achieve an output of 4,320,000 kilowatts of power from this hydroelectric power plant.

The Volkhovskaya GES imeni V. I. Lenin has been remodeled. The hydraulic structure has been renovated. Next, the main energy-producing equipment will be replaced.

Surveyors are expanding work on the site of the future Ingurskaya cascade plant, the Khudoni GES. Its planned power will be 750,000 kilowatts. Under challenging mountainous conditions, an arched dam 190 meters high will be erected.

The staff of Order of Lenin Krasnoyarskgestroy began preparatory work in December 1978 on the Maynskaya GES located 20 kilometers from the Sayano-Shushenskaya GES and downstream. The Maynskaya GES will be the "counter-regulator" for the Sayano-Shushenskaya and is designed for resetting water entering from the power-producing giant. The honor of beginning construction of the Maynskaya GES has fallen to the excavator crew headed by senior machinist A. Shesteryakov from the Administration for Mechanized Labor.

8945
CSO: 1822

ELECTRIC POWER AND POWER EQUIPMENT

FIRST TURBOGENERATOR STARTED AT SAYANO-SHUSHENSKAYA POWER PLANT

Moscow GIDROTEKHNICHESKOYE STROITEL'STVO in Russian No 3, Mar 79 pp 1-3

[Article in the column "At Five-Year Plan Construction Projects": "Heroic Victory on the Yenisey"]

[Text] On December 19, 1978, three days before the deadline specified by the hydraulic engineers in our increased socialist commitment, the first hydraulic turbogenerator of the Sayano-Shushenskaya GES [hydroelectric power plant] produced a power current (2,3). The start-up of the unit of the energy-producing giant on the Yenisey is an outstanding event in the history of hydraulic power construction. This is spectacular evidence of the powerful flight of a technical idea for a working class labor exploit and for raising the economy of our country. Hydraulic power construction experience still does not have a model for putting the first unit of a GES into operation within 38 months after damming the river. Nowhere in the world has a first hydraulic turbogenerator been started up within 18 months after beginning work on building the structure as was done by the Sayanskaya hydraulic engineers.

The unit was put into operation in the Sayano-Shushenskaya GES with reduced pressure of 60 m on the replaceable rotor and with 3.2 million cubic meters of concrete poured in the main structure out of a total volume of 10 million cubic meters.

Starting up on reduced pressure made it possible to come close to the two year deadline for putting the first hydraulic turbogenerator into operation by reducing the concrete poured in the dam prior to the GES start-up by more than 3 million cubic meters.

In the process of construction prior to receiving the rotor, the hydroelectric power plant was producing about 28 billion kilowatt-hours for the united power system of Siberia.

Not one hydraulic construction project has had such a rapid operating rate. In December 1972, the A. Naletov work crew poured the first cubic meter of hydraulic engineering concrete. The first million cubic meters of concrete had been poured by August 1976 and the second million by December 1977. Nine months in all were required for the third million cubic meters of concrete.

In August 1978, an unprecedented amount of concrete, 167,000 cubic meters, was produced in concrete plants and poured in the basic construction of hydraulic installations and other projects, 152,000 of it in basic hydraulic installation construction with a planned volume of 142,000 cubic meters for this month. The record daily concrete pouring was 7500 cubic meters.

On October 11, 1975, the Yenisey was dammed and concrete work was begun on the left bank foundation area on January 19, 1976. A hundred days in all passed between the damming of the river and complete drainage of the foundation area. Soviet and world hydraulic construction have yet to experience such a short period.

Nearly complete mechanization of operations was achieved in constructing the Sayano-Shushenskaya GES and this made it possible to develop an efficient and urgent construction tempo. Newly developed advanced techniques and methods were immediately tested in the proving grounds of construction and were adopted in practice on a broad scale. Thus, in the GES construction project, abuttment forms, heavy-duty KBGS-1000 cranes, mechanical manipulators, scrapers and many other innovations appeared.

Of the volume of concrete contained in the started-up complex of the first unit, more than 1.1 million cubic meters was poured by manipulators designed by the engineers and technicians of Krasnoyarskgesstroy. As a result of the extensive use of the equipment an average pouring of 8.55 cubic meters of concrete per shift per man was achieved. The komsomol-youth crews M. Maschenko, Yu. Vanchagova, A Kurelekha and M. Poltorana achieved 15 cubic meters and the F. Gorbaneva crew achieved 21 cubic meters of concrete per shift.

In the history of the successful start-up of the first unit, a special place is held by the question considered by the CPSU Central Committee in April 1975 in "On the Initiative of Enterprises and Organizations of Leningrad Participating in the Construction of the Sayano-Shushenskaya GES, On the Development of Socialist Competition for Reducing Work Periods and of High Quality Work in Constructing this Hydroelectric Power Plant" (1). Today one can see for oneself the great mobilizing influence this resolution of the CPSU Central Committee has had on the development of the Sayano-Shushenskaya GES. Right now, more than 170 enterprises and organizations from 14 krays and oblasts of our country are involved in socialist collaboration directed toward achieving high quality and reducing construction periods for this GES.

A new type of socialist competition proved its brilliance and was approved and recommended for broad dissemination by comrade Leonid Il'ich Brezhnev during his journey to Siberia and the Far East in April 1978 (23, p 4).

Participants in the collaboration are meeting and continuing to meet their commitments opportunely and efficiently as well as constantly and ahead of schedule.

Three months ahead of the planned deadline, the staff of the Leningradskiy Metallicheskiy Zavod association shipped the replaceable rotor for the first hydraulic turbogenerator. A team of specialists of the Leningrad association Elektrosil' installed the stator of the generator directly in the unit's crater for the first time in experience. The almost 1000 ton rotor was installed with jeweler's precision and strictly according to schedule.

The preparation period for starting up the unit was filled with the heroic labor of planners, builders, installers, mechanics, operators and specialists of the most varied trades at the construction site as well as in Leningrad, Moscow and 10 other cities of the country.

The socialist competition for proper participation in starting up the first unit and raising the banner "Glory to Labor" was especially widespread at the construction site. Fourteen thousand hydraulic engineers fought for this honor. And proving worthy of it were the komsomol-youth crews M. Mashchenko, V. Poznyakova and N. Semenenko from Gidrostroy, the communist labor brigade from Sibtekhmontazh G. Ryabchenko, the A. Kurelekha carpenter-concrete worker crew, the I. Kozhury operators crew and others. The entire staff of the fourth section of UOS-1 headed by hero of socialist labor M. Ya. Lesnikov showed examples of communist attitude.

The heroes of the start-up are the S. Kolekova carpenter-concrete worker crew and installers V. Demidenko from Spetsgidroelektromontazh, M. Sinegubova from Gidroelektromontazh and N. Poteraylo from Gidromontazh. In addition to them may be named many hundreds of workers whose self-reinforced labor was contributed to the common victory.

The heroic victory on the Yenisey received a high rating from the Central Committee of our party. General secretary of the CC CPSU, chairman of the Presidium of the USSR Supreme Soviet comrade Leonid Il'ich Brezhnev in a warm greeting (2) heartily congratulated the staffs of the building and installation organizations, machine building enterprises, scientific research and planning institutes and all participants in constructing the Sayano-Shushenskaya GES for this outstanding achievement. He emphasized that "the working friendship of Siberians and Leningraders cemented by the great organizational and political work of party organizations of the Krasnoyarskiy Kray and Leningrad Oblast, the purposeful activity of the party, trade union and komsomol organizations of collectives participating in constructing the hydroelectric power plant has enriched considerably the experience of socialist competition and will find further development in the implementation of the most important national economic programs".

On December 20, 1978, a well-attended meeting took place at the Sayano-Shushenskaya GES construction site devoted to welcoming Leonid Il'ich Brezhnev by participants in the Sayano-Shushenskaya GES construction. Inspired by the greeting from the general secretary of our party, the participants of the meeting adopted cooperative commitments of partners in scientific and technical collaboration in developing the Sayano-Shushenskaya GES directed toward the successful completion of the hydroelectric power plant construction and the early incorporation of each new unit. It was resolved to add five electrical machines by the end of the five-year plan, two of them in 1979, and to pour five million cubic meters of concrete in the dam by the 110th anniversary of Lenin's birthday.

Putting the first unit into operation was a serious test of the maturity and courage of all participants in constructing the flagship of hydraulic power on the Yenisey. And they passed this test very well. Now new, challenging problems face the staff of Krasnoyarskgesstroy. A high-water passage must be provided in 1979, two more hydraulic turbogenerators put into operation and the rate of concrete pouring increased. There is no doubt that the famous collective of the Order of Lenin Krasnoyarskgesstroy will successfully cope with these problems as well.

Engineering and technical public opinion and the editorial staff of the magazine GIDROTEKHNICHESKOYE STROITEL'STVO warmly and heartily congratulate all participants in starting up the new unit of the Sayano-Shushenskaya GES for the heroic victory on the Yenisey.

BIBLIOGRAPHY*

1. "In the CPSU Central Committee," No 7, 1975.

2. "An Outstanding Achievement," No 1, 1979.

3. "The Sayano-Shushenskaya is Working!" No 1, 1979.

4. Pretro, G. A. "The Dam of the Sayano-Shushenskaya Hydroelectric Power Plant on the Yenisey," No 4, 1964.

5. Kutenov, V. M. "Experience in Determining the Stress Condition in the Massif of Metamorphic Rock of the Sayano-Shushenskaya GES Site," No 1, 1965.

6. Pirogov, I. A. "Engineering and Geological Grounds for Choosing the Site of the Sayano-Shushenskaya GES," 1965.

7. Domanskiy, L. K. "The Sayano-Shushenskaya Hydroelectric Power Plant on the Yenisey," No 4, 1970.

8. Shnayder, I. M. "Engineering Protection from Flooding and Submerging for the City-Memorial Shushenskoye," No 4, 1970.

9. Korol', S. I. and Kazakevich, I. G. "The First Dams in the Sayano-Shushenskaya GES Construction Project," No 5, 1972.

* A list of official materials and basic articles on the Sayano-Shushenskaya GES published in the magazine GIDROTEKHNICHESKOY STROITEL'STVO is given here. Also, materials on the process of constructing this GES are systematically arranged under the heading "Socialist Competition in Action".

10. Brodilov, A. S. "Variation of the Water and Channel Operation of the Yenisey River at the Sayano-Shushenskaya GES Construction Site," No 6, 1973.

11. Grigor'yev, Yu. A.; and Abdulaeva, T. M. "New Forms of Socialist Competition," No 11, 1975.

12. Aleksandrovskaya, E. K.; Efimenko, A. I.; and Tebin, F. I. "Monitoring the Reliability of the Sayano-Shushenskaya GES Dam," No 9, 1976.

13. Efimenko, A. I.; Smyslov, V. A.; and Toropov, L. N. "Damming the Yenisey River for the Sayano-Shushenskaya GES Construction Project," No 2, 1976.

14. Grigor'ye, Yu. A.; and Skladnev, M. F. "The Scientific and Technical Conference "Effectiveness of Joint Scientific Research for the Sayano-Shushenskaya GES"," No 11, 1977.

15. "The Started-Up System of the First Hydraulic Turbogenerator of the Sayano-Shushenskaya GES," No 12, 1977.

16. Gamus, I. M. "Main and Auxiliary Equipment of the Sayano-Shushenskaya GES," No 1, 1978.

17. Kaveshnikov, A. T.; and Lentayev, L. D. "Research on Aerating the Flow in the Operating Spillway of the Sayano-Shushenskaya GES Dam," No 1, 1978.

18. Efimenko, A. I.; Garkun, L. M.; Ginzburg, Ts. G.; and Lavrinovich, E. V. "Concreting the Slab Units of the Apron Well of the Sayano-Shushenskaya GES Dam," No 2, 1978.

19. Levenikh, D. P.; Aleksandrov, M. G.; and Kusina, T. A. "The Turbine-Driven Turboconductor of the Sayano-Shushenskaya GES," No 5, 1978.

20. "Out-of-Town Session of the USSR Minenergo Board," No 9, 1978.

21. Lavrinovich, E. V.; Volkov, N. G.; Mironov, Yu. E.; Deryugin, L. M.; and Zinchenko, N. A. "Testing New Types of Vibrators at the Sayano-Shushenskaya GES," No 11, 1978.

22. Skladnev, M. F.; and Kudryavtseva, O. D. "Conference of the Central Board of NTOEiEP [Scientific and Technical Society of Power and the Power Industry] on the Sayano-Shushenskaya GES Construction Project," No 12, 1978.

23. "The Effect of Creative Collaboration of Leningrad Organizations Participating in Sayano-Shushenskaya GES Development," No 1, 1979.

24. Mikhaylov, L. P.; Skladnev, M. F.; Grigor'yev, Yu. A.; Domanskiy, L. K.; Efimenko, A. I.; and Aleksandrov, M. G. "Scientific and Technical Problems in Developing the Sayano-Shushenskaya GES," No 2, 1979.

25. Zinchenko, N. A.; and Sadovskiy, S. I. "Improvement in Management of Concrete Work in Sayano-Shushenskaya GES Construction," No 2, 1979.

26. Belov, V. S.; Gamus, I. M.; Kondrat'yev, Yu. S.; Skrylev, I. A.; and Slyn'ko, V. S. "Hydraulic Turbines of the Sayano-Shushenskaya GES," No 2, 1979.

27. Arshudze, Yu. V.; Romanov, V. V.; Sukshtau, A. A.; Yakovlev, O. I.; Kostelyanets, V. S.; and Stotskiy, A. D. "New Solutions in the Design and Technological Production of Hydrogenerators for the Sayano-Shushenskaya GES," No 2, 1979.

28. Yakovlev, O. I.; Tikhodeyev, N. N.; Tarasov, V. K.; Kovalenko, S. V.; and Filippov, Yu. A. "New Electrical Equipment and Progressive Solutions in the Electrical Portion of the Sayano-Shushenskaya GES," No 2, 1979.

29. Simochatov, N. P. "On Creative Collaboration of Participants in Sayano-Shushenskaya GES Development," No 2, 1979.

8945
CSO: 1822

FUELS AND RELATED EQUIPMENT

PETROLEUM, GAS PRODUCTION GOALS FOR FOURTH YEAR OF 10TH FIVE-YEAR PLAN

Moscow GEOLOGIYA NEFTI I GAZA in Russian No 3, Mar 79 pp 1-7

/Article: "Let Us Fulfill Ahead of Time the Plan of the Fourth Year of the 10th Five-Year Plan on the Preparation of Reserves and the Production of Petroleum and Gas"/

/Text/ Under the leadership of the CPSU the Soviet people successfully surpassed the objectives of the third year of the 10th Five-Year Plan. The past three years were filled with enthusiasm of the selfless work of the workers of country on implementing the historic decisions of the 25th party congress. The results of three years of the 10th Five-Year Plan show that the national economy of the country took another big step in its development along the path of building communism.

Along with all the Soviet people the geological explorers, oil workers and gas workers achieved significant gains in developing the petroleum and gas industry.

In 1976-1978 geological explorers of the USSR Ministry of Geology discovered 44 deposits of petroleum and gas, including 12 in Western Siberia (the Muravlenskoye, Vostochno-Tarasovskoye and others). New discoveries were made in the Central Ob' River Region, on the Yamal Peninsula, in Tomskaya Oblast, in the Komi ASSR (the Khar'yaginskoye deposit), in Astrakhanskaya Oblast and the Udmurtskaya ASSR. A new petroleum-producing region was established on the Buzachi Peninsula. The plan on the preparation of gas reserves of three years of the five-year plan for the USSR Ministry of Geology as a whole was overfulfilled, but seven territorial gas administrations (the Orenburg, Ukhta and others) did not cope with it in connection with the lag of deep drilling and the insufficiently high quality of preparation of the structures.

In the Dnepr-Donets basin five petroleum and gas deposits were found, but their reserves are small. About 50 wells are being drilled here to a depth of more than 5,000 m. In the Kazakh SSR one gas deposit and five petroleum deposits were discovered, including the Zhanazhol'skoye deposit in the eastern past of the Caspian basin. Significant gains were achieved during the 10th Five-Year Plan by the prospectors of the Uzbek SSR, on whose territory several very promising deposits confined to the shelves were found. Geological explorers of the Ministry of the Petroleum Industry discovered new petroleum and gas deposits.

In 1978 572 million tons of petroleum along with gas condensate were produced in the USSR. During the past three years the increase in the production of petroleum and condensate in the country was 80 million tons, the rate of drilling of production wells during this time increased 8 percent.

Petroleum production increased on the basis of the placement of new deposits into production, above all in Western Siberia, and also as a result of implementing measures on increasing the coefficient of extraction of the petroleum from the beds by means of the methods of formational flooding and thermal action.

The geological explorers, oil workers and gas workers of Tyumenskaya Oblast achieved considerable gains.

During the past period the oil workers of Glavtyumenneftegaz /Main Administration for Petroleum and Gas of the Tyumen' Region/ produced about 10 million tons of petroleum in excess of the plan. The commercial production volume increased 1.5-fold, petroleum production was increased by more than 104 million tons. During this period the country received more than 630 million tons of it from the Tyumen' fields.

The Tyumenskaya Oblast gas industry was developed rapidly. The gas production volume during this period increased here by 57 billion m^3, that is, the average annual increase reached nearly 19 billion m^3, which is 3.6-fold greater than during the past five-year plan. During 1976-1978 the northern deposits yielded 208 billion m^3 of this very valuable fuel and raw material.

The builders of the oblast assimilated more than 12 billion rubles of capital investments. This is more than during the entire preceding five-year plan. The working of 20 new petroleum and gas deposits was begun, 4,000 km of main pipelines were laid. The working of the Urengoy condensed gas deposit was begun in the northern part of the oblast. Roads have not yet been extended here, the people have to work under difficult conditions. But despite the difficulties, the first complex gas preparation plant was put into operation ahead of time and with an excellent rating.

While noting what has been achieved, it is necessary to address attention to the unsolved problems and shortcomings which are still interfering with more resolute progress. The November (1978) CC CPSU Plenum and the speech of Comrade L. I. Brezhnev at it make it incumbent to step up the search for untapped reserves. And there are many of them in Tyumenskaya Oblast. In particular, the deposits of liquid fuel, which geologists discovered at the beginning and in the middle of the 1960's, have been brought up to the planned level of working. The further prospects of the region involve the development of new formations which are remote from the transportation systems and industrial bases. The fate of the fulfillment of the five-year plan now depends mainly on the rate of their development. However, the assignments on the development of new petroleum areas and the construction of highways are being frustrated.

The amount of production drilling is increasing sharply. During the two remaining years of the five-year plan alone the drillers have to drill nearly 17 million m of wells, which is considerably more than during the three preceding years. The enlistment of new brigades cannot fully solve this problem. The drillers need to improve considerably all the technical and economic indicators of their work.

In April 1978 at the fields of Western Siberia the 1 billionth ton of petroleum since the beginning of the working of the deposits of Tyumenskaya and Tomskaya oblasts was produced. CC CPSU General Secretary and Chairman of the Presidium of the USSR Supreme Soviet Comrade L. I. Brezhnev congratulated the workers, engineering and technical personnel and employees, the party, trade union and Komsomol organizations of the Main Tyumen' Production Association for the Petroleum and Gas Industry and the Tomskneft' Production Association on the noteworthy conquest.

In his salute L. I. Brezhnev noted "...that these noteworthy gains were achieved as a result of the selfless labor and creative cooperation of the oil workers, geologists, construction workers, power engineers, metallurgists, machine builders, the workers of transportation, supply and many other organizations, of the utmost utilization of the modern achievements of scientific technology, advanced production know-how, the extensive development of socialist competition, the enormous organizing and political work of the party, trade union and Komsomol organizations of Tyumenskaya and Tomskaya oblasts.

"I express steadfast confidence that henceforth, by improving the organization of labor, the equipment and technology of the petroleum production processes, you will actively strive to implement the tasks outlined by the December (1977) CC CPSU Plenum on accomplishing the next stage of the program of the comprehensive development of the mineral resources and the development of the productive forces of Western Siberia."

In all 14 years have passed from that memorable date, 14 May 1964, when the first barge with petroleum of the Shaimneft' Petroleum and Gas Production Association was shipped to Omsk for refining. The beginning of the commercial working of the mineral deposits of Tyumenskaya Oblast is reckoned from that date.

More demanding objectives lie ahead. In 1978 the Tyumen' oil workers gave the homeland 245.7 million tons of petroleum, while in 1980 they should increase its production to 310 million tons and that of gas to 125-155 billion m^3.

This means that the assignments for the 10th Five-Year Plan, which are recorded in the Main Directions of USSR National Economic Development for 1976-1980, will be successfully fulfilled by the oil and gas workers of Western Siberia.

The annual increase of petroleum production here is nearly 30 million tons. All the petroleum obtained in the northern part of Tyumenskaya Oblast is shipped by pipeline transport. In order to increase the petroleum flow in the future, it is necessary to constantly increase the production capacities. During the 10th Five-Year Plan 16 petroleum pumping stations have already been tied into the operating Nizhnevartovsk-Kurgan-Kuybyshev pipeline, more than 400 km of standby lines and 990 km of the line part of petroleum pipelines have been built.

The Vyngapur-Chelyabinsk gas pipeline measuring more than 1,500 km in length has been put into operation. More than 30 billion m^3 of gas a year will be fed through it.

The northern section of the new large Perm'-Kazan'-Gor'kiy underground pipeline measuring 992 km in length has also begun to pump Siberian gas. The new gas pipeline, which is 1,220 mm in diameter, has received a flow of gas from the Vyngapur deposit. The mighty energy of three major Western Siberian deposits: the Medvezh'ye, Urengoy and Vyngapur, has flowed into the unified gas supply system of the country.

In order to transport petroleum and gas in 1979 the Urengoy-Chelyabinsk, Chelyabinsk-Petrovsk, Shebelinka-Dnepropetrovsk-Krivoy Rog-Izmail and other pipelines have to be laid. The first gas refining plant in Nizhnevartovsk, which marked the birth in Western Siberia of a mighty industry for the use of casing-head petroleum gas, was put into operation in 1975. Its productivity in 1978 increased by 300,000 m^3/hr. The bulk of the dry gas is fed to the Kuzbass, while the liquid products of gas refining: propane, isobutane, butane and pentane, travel through the southern pipeline in the direction of Tobol'sk. The very rich chemical raw materials are also sent by tank cars to plants of the Urals, Tataria, Bashkiria and the Central Volga River region.

The high rate of increase of petroleum production in the Central Ob' River region is also setting the appropriate tone for the development of the casing-head gas refining industry. By the end of the five-year plan another four large gas refining plants will be built in the Tyumen' petroleum area: the Belozernyy (which will receive the gas of the northern part of the Samotlor and Var'yeganskoye deposits), the Surgut, the Yuzhno-Balykskiy and the Lokosovskiy.

At the 18th Komsomol Congress CC CPSU General Secretary and Chairman of the Presidium of the USSR Supreme Soviet Comrade L. I. Brezhnev said: "We have to live on the Tyumen' reserves for many years to come. But in the next 10 years we are counting on obtaining the main increase of the production of petroleum, gas and the valuable chemical raw materials produced from them precisely on the basis of Tyumen'. In connection with this a new, more complicated phase of the development of Western Siberia is beginning, or rather has already begun. The amounts of all work there have to be increased two- to threefold."

The oil workers of the Tatarskaya ASSR have achieved new gains in the fulfillment of the plans and adopted socialist obligations. In three years of the five-year plan more than 295 million tons of petroleum have been produced in the republic, of them about 1 million tons are in excess of the plan.

The petroleum industry workers are increasing the production of petroleum in the regions of Western Siberia, the Komi ASSR, the Udmurtskaya ASSR and the Georgian SSR. At the same time work is being carried out in great amounts at the oil fields of Tataria, Bashkiria and Kuybyshevskaya Oblast on stabilizing the level of petroleum production: the conversion of wells to mechanized means of recovery, speeded-up schedules of the pumping of liquid from greatly flooded beds, drilling for unrecovered petroleum and in zones of stagnation, influence on the critical zone of the well. These measures are also being implemented in the old petroleum regions (Azerbaydzhan, Groznyy, the Ukraine, Central Asia). However, the production of petroleum here is decreasing from year to year.

In the Checheno-Ingushskaya ASSR, in connection with the decrease of the level of petroleum production, the exploration of deep horizons is being carried out, new deposits are being developed and secondary recovery methods are being introduced. In the republic the intensive exploration of deep-lying (more that 5,000 m) beds has continued for several years now. In particular, the Levoberezhnoye petroleum deposit, which is located on the left bank of the Terek River, was discovered and developed recently.

The construction workers of the Grozneft' Association laid ahead of time the 93-km Benoy-Groznyy condensate pipeline. The Benoy alpine condensed gas deposit for many years was closed down due to the lack of development of the area. Now the valuable raw material has begun to be fed to a separation plant for subsequent shipment to refineries. Another arm of the pipeline leads to the Goyt-Kort deposit. Here a complex for injecting high-pressure gas into the beds was built for the first time in the country. The started injection made it possible to transform several mechanized wells into free-flowing wells. All this created the conditions for stabilizing petroleum and gas production at Grozneft'.

The petroleum explorers of the Kaspmorneft' Association achieved noteworthy gains during the past three years of the 10th Five-Year Plan. Back in 1976 they discovered three new deposits: the deposit imeni M. V. Barinov, the Prichelekenskiy kupol and Yuzhnoye-2 deposits.

In 1978 the offshore petroleum and gas explorers began the drilling of the first exploratory well with a planned depth of 4,000 m with the Baky Floating Drilling Rig. The drilling of an exploratory well (6,000 m) at a promising sight of Andreyev is being carried out with another floating drilling rig, the 60 let Oktyabrya.

Heroes of Socialist Labor and drilling foremen M. Gambarov and A. Kerbalay ogly, mineral explorers of the Sangachaly Offshore Exploratory Drilling Administration, achieved high limits in the search for deep-lying petroleum, gas and condensed gas deposits in the Caspian Sea.

At the Aznefterazvedka Trust the brigade of drilling foreman and Hero of Socialist Labor S. Nagiyev, which is competing with the brigade of the famous drilling foreman of the Nizhnevartovsk Exploratory Drilling Administration, Hero of Socialist Labor L. Levin, has successfully completed the drilling of the Amirarkh-1 exploratory well (5,300 m) in Ardashskiy Rayon and has begun the drilling of the next one, the Amirarkh-3, with a planned depth of 5,500 m. The brigade of Hero of Socialist Labor I. Guseynov (the Neftyanyye Kamni Offshore Exploratory Drilling Administration), which is working at the new promising offshore site imeni 28 Aprelya, is successfully fulfilling the socialist obligations it adopted during the 10th Five-Year Plan. More than 1 billion m^3 of gas in excess of the plan were produced in 1976-1978 at the Caspian offshore fields. During the 10th Five-Year Plan the gas production here has increased fourfold.

During the remainder of the 10th Five-Year Plan the oil workers of the Apsheronskiy Peninsula should step up the drive for the increase of the petroleum production of the beds which have been worked for a long time and for the stabilization of the levels of petroleum production by means of the reconditioning of the wells and the drilling of new holes in the idle ones, the regulation of the repressuring, the extensive introduction of methods of influencing the critical zones of wells, above all the thermal and shaft means of petroleum production.

At the offshore sites it is necessary to expand the production drilling in order to involve the proven formations of petroleum, gas and condensate in production, and at the old sites to complete the development of the planned production systems.

The gas industry of the country, which provides the USSR national economy with valuable raw materials for chemical and petrochemical production and with inexpensive high calorie fuel, is being rapidly developed. The production of gas in 1978 reached 372 billion m^3. This makes it possible to presume that the workers of the gas industry, where the collectives of the Orenburggazprom, Turkmengazprom, Uzbekgazprom and Tyumengazprom associations are setting the tone, the plans of the 10th Five-Year Plan are being fulfilled much ahead of time and are being greatly overfulfilled. Thus, at the youngest gas deposit of the country--the Urengoy deposit--the first plant for the complete preparation of gas for its further transporting has reached the planned capacity, the cluster drilling of large-diameter wells, at each of which it is proposed to extract 1 million m^3 of gas a day, is being developed extensively. At the Urengoy deposit in January 1979 more than 1 billion m^3 of gas were produced, in all during the current year the Urengoy gas field workers will give the national economy of the country 30 billion m^3 of gas.

The petroleum and gas explorers are moving further and further to the north in Tyumenskaya Oblast. It is interesting to note that at the Urengoy deposit in one of the wells commercial flows of petroleum were recorded under the gas beds, which places this region among the promising multibed and multicomponent regions. Its most rapid development is a most important task of the construction workers, installers, power engineers, transport workers, drillers, oil and gas workers.

The Soviet people perceived the decisions of the November (1978) CC CPSU Plenum and the speech of CC CPSU General Secretary and Chairman of the Presidium of the USSR Supreme Soviet Comrade L. I. Brezhnev at it as a vital and directing program of actions. At this CC CPSU plenum and at the 10th Session, Ninth Convocation, of the USSR Supreme Soviet the results of national labor during the third year of the 10th Five-Year Plan were summarized and the main tasks for 1979 were specified. The State Plan of Economic and Social Development, as well as the State Budget of the country for 1979, which were approved by the November (1978) CC CPSU Plenum and were enacted legislatively by the 10th Session of the USSR Supreme Soviet, are a detailed program of the further drive to implement the historic decisions of the 25th party congress.

"...We have every reason to say," Comrade L. I. Brezhnev noted at the November (1978) CC CPSU Plenum, "that in three years of the 10th Five-Year Plan the country made substantial progress in all directions of economic and social development." 1979 will begin on the firm basis of what has been done and gained by the shock labor of millions. The third year of the five-year plan worthily passed the baton to the fourth year.

Much attention is devoted in the 1979 plan to the development of the fuel and power complex. It is planned to increase the production of petroleum and gas condensate to 593 million tons--21 million tons more than in 1978, and the production of gas to 404 billion m^3, or 32 billion m^3 more than last year.

During the fourth year of the five-year plan our national economy will receive daily 1.6 million tons of petroleum and gas condensate. If this amount were pumped into railroad tank cars, this train would stretch more than 300 km. It is planned to obtain the increase of petroleum and gas production primarily at the depostis of Western Siberia, the Komi ASSR and Orenburgskaya Oblast. It will also be necessary to built and put into operation more than 10,000 km of petroleum and gas pipelines. It is planned to mine 752 million tons of coal, or 28 million tons more than in 1978. The production volumes of fuel and electric power, which are stipulated in the plan, meet the needs of the national economy, but do not eliminate the conditions of the need for the strict observance of the policy of economy of all types of energy and the prevention of their losses.

It is planned to carry out considerable work on the exploration for new deposits of minerals, it is planned to increase the amount of geological exploration by 11.4 percent, and the amount of capital investments in the deep exploratory drilling for petroleum and gas will increase 20 percent.

In the regions of Siberia and the Far East the development of electric power engineering, the petroleum, gas and coal industries will be carried out at an accelerated rate.

In Western Siberia the largest territorial production complex for petroleum and gas production continues to be formed. New petrochemical enterprises are being built, pipelines for transporting valuable raw materials are being built, steel pipelines are being laid to industrial enterprises.

In Siberia the geologists are called trailblazers. The first detachment of Tyumen' geologists landed at taiga Surgut 20 years ago. During this time 27 petroleum deposits have been proven here. The Megion and Ust'-Balykskiy expeditions were set up on the basis of the Surgut Geological Exploration Expedition, the Ob'neftegazgeologiya Production Association was formed. The continuation of the construction of the Tobol'sk and Tomsk petrochemical combines, the Surgut-Urengoy railroad and other projects is called for.

The acceleration of scientific and technical progress is one of the primary tasks of the development of the Soviet economy. The utmost strengthening of the union of science and production, the increase of the quality and acceleration of scientific and planning developments and the rapid introduction of their results in production are playing an important role in the solution of this key problem. Scientific research organizations jointly with production enterprises have done much work on the formulation and implementation of comprehensive programs for all the petroleum- and gas-producing provinces and oblasts of the country. A map of the prediction of the presence of petroleum and gas in the USSR has been drawn up, a long-range forecast of the development of geological exploration for petroleum and gas in the country has been made, new methodological recommendations on the improvement of the exploratory and prospecting stages as a unified process of geological and geophysical work on the preparation of petroleum and gas reserves have been elaborated. The link of the developments of sectorial institutes with the basic research of the USSR Academy of Sciences in the area of the increase of the coefficient of the petroleum yield and the formation of petroleum and gas formations has been improved. At the same time scientists are faced with very important national economic problems, the solution of which should be stepped up. Among them it is possible to name: the development of methods of mapping traps of the nonanticlinal type, the detection of concentrations of petroleum and gas in the carbonaceous sections of the sedimentary section, including biohermic bodies and reefs, the stepping up of the work according to direct methods of the exploration and prospecting of formations, on the extensive testing on an industrial scale of the means of mapping petroleum and gas formations using electric geophysical exploration, the improvement of the methods of the discrete prediction of petroleum and gas, as well as the forecasting of the content of condensate in the gas concentrations at the exploration stage. It is necessary to see to it that not one development of the sectorial institutes remains outside the plan of introduction into production. It should be fully realized that scientific developments can influence to a considerable extent the increase of the economic efficiency and quality of the geological exploration for petroleum and gas.

The construction of such a major integration project as the giant 2,750-km Soyuz main gas pipeline from the region of Orenburg to the western border of the USSR was completed in January 1979. More than 15 billion m^3 of gas a year will be fed through it to the European CEMA member countries.

In his salute to the participants in the construction of the Soyuz main gas pipeline and the Orenburg Gas Complex Comrade L. I. Brezhnev emphasized: "This immense construction project has become one of the most convincing examples of the development of the new forms of cooperation of the socialist countries in the solution of key economic problems on an equal and mutually advantageous basis." It is the first time in the history of integration cooperation that such a large-scale project has been built by the joint forces and assets of all the interested states (Bulgaria, Hungary, the GDR, Poland, the USSR, the CSSR, Romania; the last country participated in financing the purchases of equipment).

The delivery of gas through the Soyuz gas pipeline will help our partners to improve the fuel and power balance, to clean up the air basin of cities and to consolidate the raw material base of the chemical industry.

The construction of the Soyuz gas pipeline became a vivid display of socialist internationalism in action. In honor of the 30th anniversary of the Council for Mutual Economic Assistance the workers of the Soyuz gas pipeline undertook to bring the pipeline up to the planned capacity in the shortest possible time.

Soviet geological explorers, petroleum and gas workers are performing considerable work in 30 countries of the world, helping them in the exploration, prospecting and working of petroleum and gas deposits. At the same time much work is being carried out in the developing countries on training staffs of workers and engineering and technical specialists. The international duty of Soviet geologists, oil and gas workers is henceforth to bear with honor at all sections of work abroad the lofty title of a Soviet individual, a worthy representative of the country of Great October.

The decisions of the November (1978) CC CPSU Plenum, the speech at the plenum of CC CPSU General Secretary and Chairman of the Presidium of the USSR Supreme Soviet Comrade L. I. Brezhnev and the decrees of the 10th Session, Ninth Convocation, of the USSR Supreme Soviet were fervently supported by all the Soviet people. Siberians and the workers of Tyumenskaya Oblast are setting the tone among the geological explorers, oil and gas workers. The collectives of the enterprises and organizations of the oblast, in implementing the decisions of the 25th CPSU Congress, assumed for 1979 the socialist obligations: "By increasing the amount of drilling work, by improving the working of deposits, by increasing the petroleum output of the beds and by assimilating new deposits and capacities, to increase the production of petroleum during the year by 29.3 million tons, to increase it to 275 million tons, which is 7.6 million tons more than stipulated by the five-year plan. To produce 125.5 billion m^3 of gas, 33 billion m^3 more than in 1978 and 7.3 billion m^3 more than the assignment of the five-year plan for the current year. To improve the use of casing-head petroleum gas, to increase the capacities for refining it to 13 billion m^3 as against 9 billion m^3 in 1978. To increase the amount and effectiveness of geological exploration work, to overfulfill the plan on the increase of petroleum reserves by 20 percent, to complete the fulfillment of the five-year plan on the prospecting for gas.... To build 2,900 km of main petroleum pipelines, including a section of the Surgut-Polotsk petroleum pipeline, the Urengoy-Chelyabinsk gas pipeline, 11 gas compressor stations, plants for the preparation of 24.7 million tons of petroleum and 25 billion m^3 of gas a year, the commercial raw material base at the Tobol'sk Petrochemical Combine.... To bring the laying of railroad tracks on the Surgut-Urengoy line to the 480th kilometer."

By means of the utmost increase of production efficiency and work quality the workers of the Turkmen SSR have assumed the socialist obligation of producing in 1979 21,000 tons of petroleum and 1.1 billion m^3 of gas in addition to the plan. The workers of the Azerbaydzhan SSR have pledged to produce in excess of the plan 120 million m^3 of gas, of the Ukrainian SSR--570 million m^3 of gas, of the Uzbek SSR--100 million m^3 of gas, and of the Georgian SSR--10,000 tons of petroleum.

There is no doubt that the geological explorers, oil and gas workers following the example of the workers of Tyumenskaya Oblast will develop even more extensively the socialist competition for the early fulfillment of the plan of the fourth year of the 10th Five-Year Plan on the preparation of reserves and the production of petroleum and gas, will take new steps in the implementation of the decisions of the 25th CPSU Congress and will undertake everything in order to implement the plans of the party and so that our great socialist homeland would prosper even further.

7807
CSO: 1822

FUELS AND RELATED EQUIPMENT

UDC 553.98.041.003.12

CLASSIFICATION OF PETROLEUM, GAS BEARING TERRITORIES

Moscow GEOLOGIYA NEFTI I GAZA in Russian No 3, Mar 79 pp 8-11

/Article by G. P. Ovanesov, A. A. Aksenov, Ministry of the Petroleum Industry: "Evaluation of the Prospects of the Presence of Petroleum and Gas in Territories"1/

/Text/ Much attention is being devoted to questions of increasing the reliability of the prediction of the presence of petroleum and gas and the estimation of the reserves of accumulations of hydrocarbons. The numerous publications and the extensive discussion on the pages of various publications attest to this /2, 3, 5-11/.

The evaluation of the prospects of the presence of petroleum and gas in territories, which represents the final phase of their comprehensive geological study, should be based on the comprehensive analysis of the factors which determine the conditions of the formation, distribution and preservation of accumulations of petroleum and gas.

The experience of studying promising territories shows that in regional petroleum and gas bearing areas the spatial distribution of commerical formations is controlled, above all, by the features of the tectonic structure and the nature of the development of the collectors. When singling out regions which are promising to different extents, the main importance is ascribed precisely to these factors. However, such an evaluation will not be exhaustive without consideration of the petrological facial, geochemical and hydrogeological conditions, the data on the actual presence of petroleum and gas, the structure of the selected formations, the degree of the geological and geophysical study of the territories under investigation and so on.

When evaluating quantitatively the prediction of the presence of petroleum and gas in the country it is necessary to select well-explored commercial petroleum and gas bearing regions with a high degree of detection of

---

1. By way of discussion.

potential resources, within which it is difficult to expect a significant increase of reserves. Such regions should be regarded as reference regions, by analogy with which an estimate should be made of the possible reserves of hydrocarbons on the sites adjacent to them or on the territories which have a similar geological structure.

It seems necessary when evaluating the prospects according to a set of factors, which determine the features of the structure and the nature of the presence of petroleum and gas, as well as with allowance for the degree of geological and geophysical study to single out the following categories of petroleum and gas bearing territories.

It is feasible to divide the highly promising territories into regions with an established presence of petroleum and gas and regions in which they are presumed to be on the basis of scientific prediction.

The former should have commercial formations (or at least commercial flows) and should be distinguished by the most favorable conditions for commercial petroleum and gas accumulation: by pronounced major structural uplifts or good traps of screening, great thicknesses of the producing horizons with high collector properties and so on.

The regions with a probable presence of petroleum and gas as compared with the former regions should be distinguished by the absence of commerical formations, but should be characterized by the most favorable conditions possible for commercial petroleum and gas accumulation.

The promising territories can be divided in much the same way as the highly promising territories. The regions with an established presence of petroleum and gas should contain commercial formations (or commercial flows), but should be characterized, unlike the highly promising regions, by somewhat less favorable conditions for the commercial accumulation of petroleum and gas.

The regions with a probable presence of petroleum and gas, as compared with the former regions, in the absense of detected formations or commercial flows should have favorable conditions for commerical petroleum and gas accumulation.

The slightly promising territories have not very favorable factors which control the commercial presence of petroleum and gas (poorly developed producing horizons, low collector properties and so on).

The territories, in which the optimum conditions for the formation of commercial accumulations of hydrocarbons are absent, are unpromising. An estimate of the reserves is not made for these regions.

The unstudied territories, for which there is no information making it possible to judge the features of their structure, are ascribed to the territories with an undetermined promise.

While proposing the indicated division of territories according to the degree of the prospects of the presence of petroleum and gas, which is based on the data of the comprehensive qualitative geological analysis with allowance for their degree of geological and geophysical study, as well as the existence of the commercial presence of petroleum and gas or its prediction according to the materials of the use of the method of geological analogy, it is necessary to stress its practical direction, which determines the nature of the necessary geological exploratory work which is planned for the purpose of detecting new commercial deposits and formations of petroleum and gas.

The highly promising grounds with an established presence of petroleum and gas are the primary grounds for the performance of research which is aimed directly at the exploration for formations of petroleum and gas and the further increase of their reserves. Accordingly, the regions in which the presence of petroleum and gas is presumed on the basis of scientific prediction will be primary for the organization of regional or reconnaissance, and then structural exploratory work, which is being performed for the purpose of finding specific promising objects of subsequent exploratory and test drilling for detecting and mapping the formations of hydrocarbons and increasing their reserves. The territories with an undetermined promise should be taken into account when organizing the orientation or parametric drilling on the basis of the regional, above all, geophysical work, the slightly promising territories should be a reserve for the future; the unpromising territories should be excluded from the planning and performance of geological exploratory work.

When compiling forecasting charts the evaluation of the prospects of the presence of petroleum and gas governs the insertion in them of the specific workload. These charts should be designed for individual petroleum and gas bearing complexes and should reflect their structural design, the petrological collector conditions, the nature of the geochemical and hydrogeological conditions, the data on the presence of petroleum and gas, as well as the degree of concentration of the reserves (the density) by the zones (regions) of petroleum and gas accumulation and their quantitative value.

It is especially necessary to examine the questions connected with the classification of the reserves of petroleum and fuel gasses, which requires refinement [4].

Thus, whereas the reserves of categories A and B (of the current classification) are defined quite precisely, according to their proven commerical presence of petroleum and gas, C_1 and especially C_2 do not have such an unambiguity and include reserves which have been studied to a different degree and have a different productivity. It is worth indicating that the reserves of the formations, in which the presence of petroleum and gas has been established not only on the basis of the obtained commercial flows of petroleum or fuel gasses in individual wells (some of the wells might be analyzed by a tester of the beds), but also on the basis of favorable field geophysical data at a number of other wells, as well as the resources of a portion of the formation (tectonic block), which is adjacent to sites with reserves of higher categories, are assigned to category C_1.

Thus, the reserves of insufficiently explored formations are assigned to category C_1, therefore their quantitative evaluation is tentative. Practice shows that in the further exploration of such sites within the initial outlines of the estimate these reserves are revised, as a rule, downward /1, 8/.

The evaluation of the reserves of category C_2 is even less reliable. The reserves, the presence of which is presumed on the basis of favorable geological and geophysical materials in individual unexplored fields, tectonic blocks, new horizons of studied deposits, as well as the reserves in the new structures within petroleum and gas bearing regions, which have been mapped by proven methods of geological and geophysical research, are assigned to this category, that is, the combination of reserves of a varying degree of certainty is also typical of category C_2.

As a result, it is necessary to make more precise the demands which are made on the reserves of categories C_1 and C_2. It seems more valid and logical to limit category C_1 to the reserves of formations, in which the presence of petroleum and gas has been established on the basis of obtained commercial flows of petroleum or gas in individual wells (a portion of the wells can be analyzed by a tester of the beds) and favorable field geophysical data in a number of wells on the sites adjacent to areas with reserves of higher categories. In order to increase the reliability of the evaluation the reserves of some unexplored fields and tectonic blocks should be excluded from this category.

The proposed refinement is aimed above all at increasing the strictness of the demands on the reserves of category C_1, which along with categories A and B belongs to the group of commercial categories. This is necessary in connection with the planning in recent years of an increase of the reserves only for categories $B + C_1$, which under the conditions of the limited amount of exploratory drilling leads in practice to an increase of the reserves only for category C_1.

The latter circumstance has an adverse effect on the degree of certainty of the commerical reserves which are being received toward the account of the state and are the main basis which determines the real level of petroleum production.

With allowance for what has been said, the reserves of category C_2 should be limited only to those which are connected with unexplored sites (tectonic blocks) and untested horizons in the ascertained deposits.

We propose to include the reserves of the promising structures, which have been readied for exploratory drilling, in the quantitative evaluation of the prediction of the presence of petroleum and gas (group D), in which it is feasible to single out two subgroups: D_1 and D_2.

There should be assigned to subgroup D_1 (to depths of up to 5,000 m) the quantitative evaluation of:

a) the structures which have been prepared for exploratory drilling by geological and geophysical methods which ensure the sufficiently reliable mapping of the potentially productive horizons and series within the regions with the established commercial presence of petroleum and gas;

b) the area of little studied territories with the established commerical presence of petroleum and gas.

There should be assigned to subgroup D_2 (to depths of up to 5,000 m) the quantiative evaluation of:

a) the structures which have been prepared for exploratory drilling by geological and geophysical methods within the regions with the unestablished presence of petroleum and gas;

b) the areas of poorly studied territories with the unestablished presence of petroleum and gas;

c) the sections to depths of 5 to 7 km.

On the whole the quantitative evaluation of the prediction of the presence of petroleum and gas in territories can serve only as a basis for planning exploratory and prospecting work and, above all, regional work for determining the main traits of the features of their structure and, consequently, should not be used in the estimates of the potential levels of petroleum production for the immediate future.

In connection with the latter circumstance it is also necessary to examine the question of evaluating the potential reserves. In recent years this concept has found quite extensive application. It is customary to mean by such reserves the total value of the reserves of the commerical categories $A + B + C_1$, category C_2, the quantitative evaluation of the prediction of the presence of petroleum and gas, as well as the accumulated production for all the years of working of deposits. So-called current potential reserves according to the status on a specific date, which, unlike the total evaluation of the potential reserves, do not include the accumulated production, are also used in practice.

The need to evaluate the potential resources is obvious. However, here it is also necessary to take into account the varying degree of reliability of its components, bearing in mind, above all, the low reliability of the quantitative evaluation of the prediction of the presence of petroleum and gas, which to a considerable extent is probabilistic. Therefore, it is more correct when determining the potential reserves of the territories under investigation to reflect their magnitude with a "fork" with the minimum and maximum values, introducing the appropriate correction factors for the degree of confirmability of the reserves of various categories, the reliability of the prediction and so on. This will make it possible to evaluate more realistically the potentials of the petroleum production of individual regions, as well as the necessary amounts of exploratory and prospecting work.

Everything stated above reflects the complexity and debatability of many questions connected with the determination of the promise of the territories being studied, the establishment of the category of the reserves of petroleum and gas, their certainty, the planning of exploration and prospecting and so on. Apparently, the need is quite ripe for the discussion of these questions at a special all-union conference with the involvement of all the ministries and departments which are performing exploratory and prospecting work for petroleum and gas and are analyzing the reserves, as well as the planning organs which determine the levels of production, the increase of the reserves and the amounts of geological exploratory work, with the participation of scientific research institutes of the corresponding specialization.

BIBLIOGRAPHY

1. V. A. Melik-Pashayev, V. A. Breyev, G. T. Voronova, M. N. Kochetov, "The Analysis of the Confirmability of the Petroleum Reserves of Categories C_1 and C_2 When Converting Them to Higher Categories," NEFTEGAZ. GEOL. I GEOFIZ., No 6, 1975, pp 28-31.

2. N. I. Vuyalov, "A Method of Predicting the Presence of Petroleum and Gas," GEOLOGIYA NEFTI I GAZA, No 12, 1977, pp 12-18.

3. Ye. V. Zakharov, N. I. Buyalov, "Methodological Principles of the Forecasting Estimates of the Reserves of Petroleum and Gas. A Review," series of NEFTEGAS. GEOL. I GEOFIZ., Moscow, VNIIOENG, 1976, pp 1-43.

4. "Instruktsiya po primeneniyu klassifikatsii zapasov mestorozhdeniy nefti i goryuchikh gazov" /Instructions on the Application of the Classification of the Reserves of Deposits of Petroleum and Fuel Gasses/, Moscow, Nedra, 1972.

5. V. I. Shpil'man, G. P. Myasnikova, G. I. Plavnik, T. N. Pertyakova, "A Method of Estimating the Predicted and Prospective Reserves and the Substantiation of Estimated Parameters," TRUDY ZAPSIBNIGNI, No 53, 1972, pp 1-178.

6. I. I. Nesterov, "Kriterii prognozov neftegazonosnosti" /Criteria of the Predictions of the Presence of Petroleum and Gas/, Moscow, Nedra, 1969.

7. G. P. Ovanesov, V. S. Melik-Pashayev, "On Refining the Classification of Reserves of Petroleum and Gas for the Purpose of Increasing Their Certainty," GEOLOGIYA NEFTI I GAZA, No 10, 1976, pp 16-21.

8. G. P. Ovanesov, M. V. Feygan, "On the Question of the Confirmability of Petroleum Reserves of Categories C_1 and C_2," GEOLOGIYA NEFTI I GAZA, No 8, 1975, pp 7-14.

9. F. K. Salmanov, O. A. Remeyev, "On the Classification and Classificatory Accounting of the Reserves of Petroleum, Gas and Condensate," GEOLOGIYA NEFTI I GAZA, No 9, 1976, pp 11-18.

10. S. P. Maksimov, V. I. Yermakov, G. Kh. Dikenshteyn et al., "The Status of the Development of a Method of Estimating the Reserves of Petroleum, Gas and Condensate," GEOLOGIYA NEFTI I GAZA, No 12, 1977, pp 1-6.

11. V. V. Stasenkov, G. B. Kudryukova, "An Amendment to the Classification of Petroleum and Gas Reserves," GEOLOGIYA NEFTI I GAZA, No 10, 1977, pp 32-34.

12. V. D. Nalivkin, M. D. Belonin, V. S. Lazarev, G. P. Sverchkov, "The Theoretical Principles of Predicting the Presence of Petroleum and Gas," GEOLOGIYA NEFTI I GAZA, No 12, 1977, pp 7-12.

7807
CSO: 1822

FUELS AND RELATED EQUIPMENT

UDC 553.98.061.4(470.56)

ANALYSIS OF SUPERCOLLECTORS OF ORENBURG CONDENSED GAS DEPOSIT

Moscow GEOLOGIYA NEFTI I GAZA in Russian No 3, Mar 79 pp 20-28

/Article by I. P. Zhabrev, Ministry of the Gas Industry, M. A. Politykina, Southern Siberian Department of the All-Union Scientific Research Institute of Geological Exploration for Petroleum, Yu. V. Uchastkin, Orenburggazdobycha: "Supercollectors of the Orenburg Condensed Gas Deposit"[1]/

/Text/ The information about the physical properties of the rock, which is obtained in the process of drilling wells, is of great importance. This work is devoted to an analysis of the complications which were noted when drilling the exploratory and production wells of the Orenburg condensed gas deposit.

Its production section with a thickness of up to 500 m is formed by a series of carbonaceous rock of the Middle Carboniferous and Lower Permian ages. The detection of the productive series is made in a drilling mud, for the preparation of which bentonite is used, while barium oxide is used as a weighting compound. The parameters of the solution fluctuate within the following limits: a density of 1.32-1.68 g/cm^3, a viscosity of 30-90 centipoise, a water yield of 3-8 cm^3.

In the drilling of 57 wells 92 cases of the absorption of the flushing fluid were recorded, 77 of them in the gas saturated series, the remainder below the gas-liquid interface. All the parameters on the absorption were tabulated. The correlation of the absorption intervals according to the data of field geophysics made it possible to distinguish several zones in the section of the productive series.

In the Middle Carboniferous sedimentations four zones were established, which according to the site occupy the western half of the anticlinal section of the central part of the deposit (Figure 1). Rock of the Middle Carboniferous was not discovered on the bulk of its remaining territory.

1. By way of a discussion.

(1) Номер скважины	(2) Интервал (глубина) поглощения, м	(3) Параметры бурового раствора		(6) Параметры поглощения		(9) Интенсивность поглощения
		(4) плотность, г/см³	(5) вязкость, с	(7) давление столба раствора, кгс/см²	(8) репрессия на пласт, кгс/см²	
18	1500					Полное поглощение (12)
(10)18-Д	1645	1,55	45	255	53	То же (13)
22	1948—1957	1,28	25			25 м³/ч и с глубины (14) 1957 м полный уход
(11)27-Д	1496—1498	1,53	50	229	30	25 м³/ч (15)
27-Д	1639	1,47	45	241	40	15 м³/ч
27-Д	1754	1,47	50	257	51	Полное поглощение (12)
31	1756	1,34—1,38	35—45	239	33	2 м³/ч
32	1805	1,32—1,37	35	241	34	21 м³/ч
32	1833	1,32—1,37	35 35	246	34	2—2,5 м³/ч
32	1867	1,32—1,37	35	250	42	Частичное поглощение (16)
32	1879—1902	1,32—1,37	35	253	50	35—40 м³/ч
32	1908—1915	1,36	37	260	53	Интенсивное поглощение (17)
51	1744	1,36	27	237	31	Полное поглощение (12)
94	1538	1,57	90	241	39	То же (13)
101	1462	1,64	54	239	40	Частичное поглощение (16)
101	1513—1522	1,62	75—80	246	47	12 м³/ч
101	1550	1,60	50	248	48	12 м³/ч
101	1625—1635	1,6	75—80	261	60	12—15 м³/ч
122	1657—1658	1,50	60	249	49	6 м³/ч
140	1540	1,53		236	37	1—1,5 м³/ч
144	1680—1694	1,55	50	262	60	2—3 м³/ч
148	1784	1,5		268	64	1,5 м³/ч
170	1723	1,51	45	260	58	Полное поглощение (12)
173	1725—1726	1,45	40	249	47	То же (13)
174	1727	1,56	45	270	67	20 м³/ч
183	1513	1,57	35	236	37	Полное поглощение (12)
185	1380	1,58	35—45	218	22	2—4 м³/ч
185	1392—1394	1,57	43	237	40	Полное поглощение (12)
185	1449	1,56	45	226	27	6 м³/ч
185	1452					Полное поглощение (12)
188	1600	1,61	75	256	55	То же (13)
188	1605	1,61	75	257	56	» »
189	1524	1,65	40	252	53	» »
189	1532	1,65	40	253	54	» »
198	1594	1,65	40	263	62	» »
213	1604	1,48	50	237	36	Частичное поглощение (16) (3 м³/ч)
216	1657	1,53	60	254	53	Полное поглощение (12) (80 м³)
219	1750					Полное поглощение (12)
412	1737	1,35	40	245	43	То же (13)
413	1664	2,42		236	35	20 м³/ч
457	1615	1,48	45	240	35	15 м³/ч
506	1789	1,4	40	251	45	10 м³ ч
527	1861	1,32	30	245	37	Полное поглощение (12) (100 м³)
712	1560—1580	1,44	35	227	32	Полное поглощение (12)
713	1389	1,57	41	218	28	13 м³/ч
713	1691	1,52	130	257	62	Полное поглощение (12)
102	1539—1543	1,6	32	246	46	55 м³/ч

/Table continued on following page/

(1) Номер скважины	(2) Интервал (глубина) поглощения, м	(3) Параметры бурового раствора		(6) Параметры поглощения		(9) Интенсивность поглощения
		(4) плотность, г/см³	(5) вязкость, с	(7) давление столба раствора, кгс/см²	(8) репрессия на пласт, кгс/см²	
102	1779	1,62	33	288	82	За 20 мин—70 м³ (18)
102	1785	1,62	43	290	84	70 м³/ч
104	1520	1,60	20	243	44	20 м³/ч
106	1337—1341	1,66	37	222	25	5 м³/ч
106	1386—1308	1,65	32	229	31	Частичное поглощение (16)
106	1445—1447	1,67	40	240	41	6 м³/ч
106	1492	1,68	40	250	50	Частичное поглощение (16)
106	1502—1516	1,68	43	254	55	Полное поглощение (12)
108	1716	1,62	30	278	75	Катастрофическое поглощение (19)
108	1634	1,62	30	265	64	20 м³/ч
109	1719	1,38	40—55	236	33	20 м³/ч
109	1484—1485	1,65	80	248	49	4 м³/ч
109	1500	1,60	90	240	40	3 м³/ч
109	1533—1538	1,60	90	246	45	За 30 мин 15 м³, затем 1 м³/ч (20)
109	1653	1,61	110	265	64	6 м³/ч
110	1546	1,6	72	248	48	Полное поглощение (12)
111	1698—1702	1,6	43	272	70	24 м³/ч
115	1670	1,59	70	265	64	Полное поглощение (12)
116	1485	1,56	35	230	32	То же (13)
118	1748—1752	1,58	60	276	70	50 м³/ч
120	1722	1,33	28	229	26	17—26 м³/ч
120	1746	«	«	232	29	17 м³/ч
120	1611—1627	1,52	40	245	45	Полное поглощение (12) (84 м³)
120	1646	1,52	48	251	50	3 м³/ч
120	1746	1,28	23	224	18	Частичное поглощение (16) (5 м³/ч)
121	1632—1642	1,45	43	237	36	Полное поглощение (12)
717	1645—1650	1,48	38	244	43	10 м³/ч
731	1711	1,43	27	244	49	Частичное поглощение (16)
735	1544	1,53	55	236	41	Полное поглощение (12)

Key:

1. Well number
2. Interval (depth) of absorption
3. Parameters of drilling mud
4. Density, g/cm^3
5. Viscosity, centipoise
6. Parameters of absorption
7. Pressure of column of mud, kg/cm^2
8. Repression on bed, kg/cm^2
9. Intensity of absorption
10. 18-D
11. 27-D
12. Complete absorption
13. The same
14. 25 m^3/hr and beginning at a depth of 1,957 m complete escape
15. m^3/hr
16. Partial absorption
17. Intensive absorption
18. After 20 minutes, 70 m^3
19. Catastrophic absorption
20. After 30 minutes 15 m^3, then 1 m^3/hr

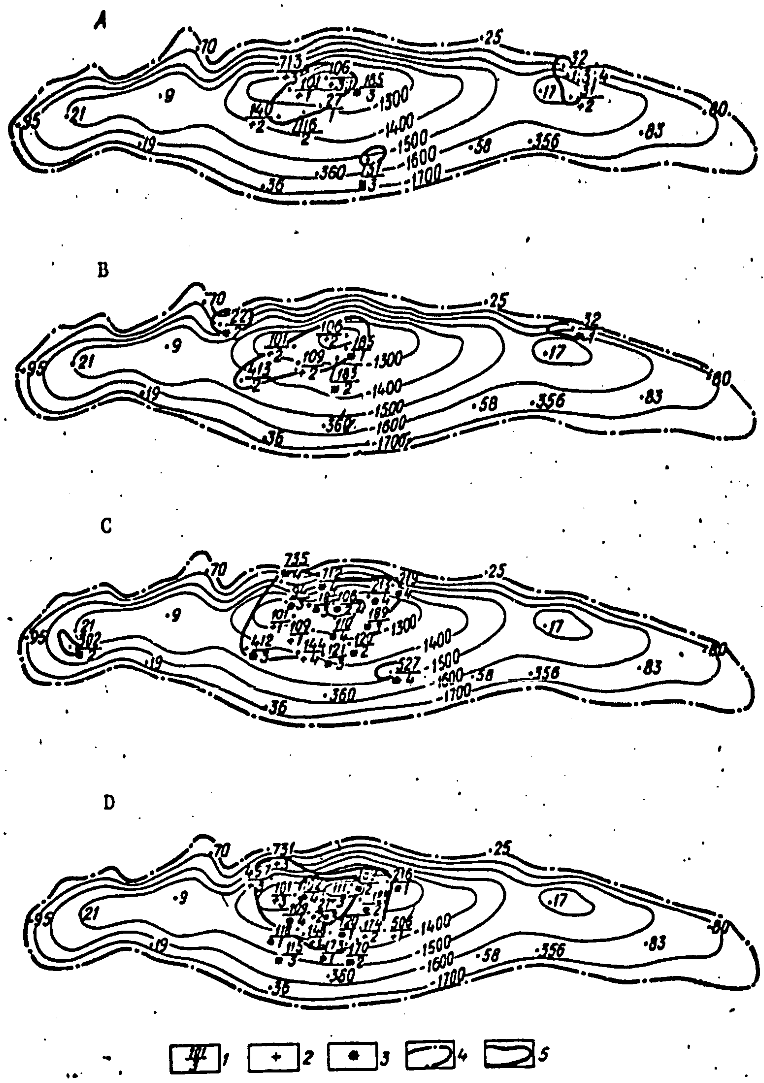

Figure 1. Scheme of Distribution of Absorption Zones in Sedimentations of the Artinskiy (A), Sakmarskiy (B), Assel'skiy (C) Stages and Upper and Lower Carboniferous (D). 1--in the numerator is the well number, in the denominator the absorption zone number; nature of absorption: 2--partial, 3--catastrophic (complete); 4--gamma-neutron logging; 5--boundary of spread of absorption zone.

The first (lower) absorption zone is characterized by the complete escape of the flushing fluid in well 102; according to the core sample of well 321, which was drilled using a calciferous bitumenous mud (IBR), it is represented by a bed 2.1 m thick (1,811.2-1,813.3 m) of organogenic limestone with a platy texture. The platiness is caused by horizontal open fractures, the distance between which is from 5 to 30 mm.

The second absorption zone is located 100 m above the first zone. It was established by partial absorption in well 111; according to the core sample of well 321 (a depth of 1717.4 m) it is confined to a thin (0.5 m) bed of organogenic detrital limestone. The thickness of the plates is 20-25 mm, the penetration of the filtrate of the IBR between them was observed.

The third zone is 20 m from the preceding one and is characterized by the complete escape of the drilling mud in wells 713 and 27-D and the partial escape in well 109. According to the data of field geophysics, it is connected with a thick (up to 10 m) collector bed, which is maintained well within the central part of the deposit, with an average porosity according to the core sample of 14 percent. The bed is formed by the even interstratification of algal, organogenic detrital and detrital limestones; the thickness of each layer is 1-1.1 m. Apparently, the absorption is confined to the organogenic detrital varieties with a small amount of cement. According to the core sample of well 321 (1,698.4-1,700 m) the absorption zone is represented by a 1.5-m bed of organogenic detrital platy limestone; the thickness of the plates is from 5 to 35 mm. The platiness is caused by a system of subhorizontal open fractures, through which the penetration of the filtrate of the IBR was noticed.

The fourth (highest) zone is 36 m above the preceding one and is located by the complete absorption of the flushing fluid in wells 108 and 18-D and partial absorption in wells 717, 120 and 3. As the data of field geophysics showed, it is connected with a collector bed 6-10 m thick, which is maintained within the central section of the deposit, is compact in the middle part and is nonuniform in permeability. It is represented by the even alternation of organogenic limestones of different species composition with organogenic detrital varieties. According to the core sample of well 321 (1,664-1,665.5 m) the absorbing bed is formed by platy organogenic detrital limestone. The platiness is caused by subhorizontal open fractures with a distance of 15-25 mm between them. The penetration of the filtrate of the IBR is noticed through them (Figure 2 /photograph not reproduced/).

The absorption zones in the Upper Carboniferous rock have the greatest area. They are developed mainly in the dome part of the central block of the deposit (see Figure 1). Three zones are singled out in the section. The first one (the lower) is characterized by a considerable intensity of absorption: the complete escape of the flushing fluid was observed in wells 173, 216 and 118; the partial escape was observed in wells 731 and 148. According to the data of the field geophysical studies in well 118, it is connected with a thin (2 m) collector bed which is porous according to the neutron-gamma logging. According to the core sample of well 321 (1,623.6-1,627 m) this zone is represented by a bed of organogenic limestone 3.4 m thick with a distinct system of subhorizontal open fractures, through which the penetration of the filtrate of the IBR was observed. The thin plates, into which the rock is easily broken, in places crumble into dust.

The second zone is located 32-40 m below the roof of the Upper Carboniferous rock and is characterized by the complete escape of the flushing liquid in wells 188 and 189 and by intensive absorption in wells 170 and 174. According to the data of the field geophysical observations in the last two wells, it is confined to a collector bed 6 m thick, which is porous according to the neutron-gamma logging and permeable according to the microlog probe. It is represented by the even interstratification of limestones of concentrated small foriminiferous, polydetrital and cloddy fusulina composition with sparse cement of contact and an interstitial cement. According to the data of well 321 (1,607.4-1,609 m) the absorbing zone is formed by organogenic limestone with a platy texture. The penetration of the filtrate of the IBR between the plates was noticed.

The third zone is located near the roof of the indicated section (3-6 m from the roof) and is characterized by complete absorption in wells 115 and 120 and by partial absorption in well 101. According to the field geological measurements in well 115, the absorption is confined to a 1.5-m bed, which is weakly permeable according to the microlog probe and occurs in a block of dense rock. According to the core sample of well 321 (a depth of 1,568 m), this zone is represented by a bed (0.6 m) of platy organogenic detrital limestone; the distance between the plates is from 7 to 30 mm.

The maximum intensity of absorption is noted in the Assel'skiy sedimentations and is observed on a considerable territory (see Figure 1). Four absorption zones have been established in the section. The lower zone, which is characterized primarily by complete and catastrophic absorption (wells 712, 102, 106, 110, 527), has the greatest area distribution. Judging from the field geophysical materials of wells 102, 110 and 122, the absorption is confined to a weakly porous 2-m thick bed, which is located in the middle part of a dense impermeable block of rock 12-13 m thick. According to the mud of well 106 platy limestones are encountered in this part of the section. According to the core sample of well 321 (1,553.3-1,556.3 m) the zone is represented by dolomitized organogenic limestones with a platy texture, which are slighty honeycombed in places. The distance between the open subhorizontal fractures, which cause the platiness, is 2-15 mm.

The second zone has the greatest intensity and is noted by complete absorption in wells 18, 189, 94, 412 and 121. According to the core sample of well 321 it is formed by a bed (1.5 m) of platy organogenic limestone, the thickness of the plates is 5-20 mm. The penetration of the filtrate of the IBR was noticed through the subhorizontal open fractures.

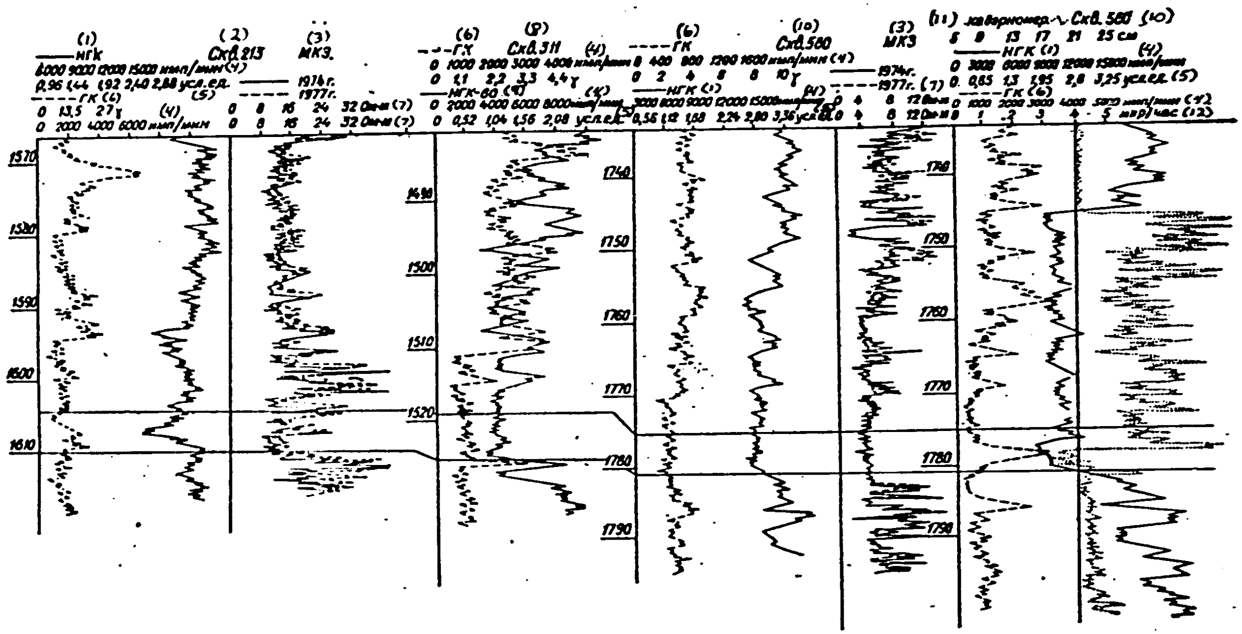

Figure 4. Diagram of the Correlation of the Upper Absorption Zone of the Assel'skiy Stage Along the Line of Wells 213-331-560

Key:

1. Neutron-gamma logging
2. Well 213
3. Microlog probe
4. Pulses/minute
5. Conventional units
6. Gamma logging
7. Ohm·minutes
8. Well 311
9. Neutron-gamma logging 60
10. Well 560
11. Caliper
12. Microreontgens/hour

The third zone is located approximately 26 m from the roof of the stage and is characterized by the complete escape of the flushing fluid in well 120 and the partial escape in well 106. Catastrophic absorption in this zone also appeared in the western part of the deposit (well 302). The correlation of the sections of the indicated wells and orientation well 321 showed that the absorption is connected with a 3.1-m thick bed (1,534-1,537.1 m) of platy organogenic detrital limestone which is easily broken into dust.

The upper, fourth zone is located near the roof of the stage (6 m from the roof), is established by the complete escape of the drilling mud within the northern steep side (wells 213, 219, 735) and partial absorption in wells 101, 104 and 109 and is connected with a 2-4 m thick bed which is porous according to the neutron-gamma logging and permeable according to the microlog probe. According to the core sample of orientation well 311 (1,518-1,521 m) this bed is formed by platy organogenic dolomitized limestone; the distance between the open fractures, which cause the platiness, is 10-15 mm, in places it decreases to 2-5 mm; the penetration of the filtrate of the IBR was noticed through the fractures. The geophysical research performed during the reconditioning of well 560, which showed the presence of an artificial argillaceous crust at the interval of 1,776-1,781 m, which corresponds to the described absorption zone (Figure 3), attests to the quite appreciable area of development of this high capacity bed.

Two main absorption zones are noted in the sedimentations of the Sakmarskiy stage. The first zone is located 40-45 m from its roof. It has considerable absorption: the complete escape of the flushing fluid was observed in three wells (184, 413, 22), partial absorption was observed in well 109, negligible dips of the instrument were noted in well 106. The absorption is connected with a thin (3 m in well 106) bed which is porous according to the neutron-gamma logging and is represented (according to the drilling mud of well 106) by platy limestones. The correlation of this bed according to the sections of both old and new wells, which were drilled using the IBR and with a large removal of the core sample, showed that in the western part of the deposit (well 312, a depth of 1,665 m) it is expressed by a thin intercalation of thin platy limestone, in which horizontal fractures split the rock at 1-2 mm intervals; in the central part (well 311, a depth of 1,490 m) by thin platy limestone 3 m thick, which is broken into dust; in the eastern part (well 352, a depth of 1,790 m) by a 1.5-m layer of platy limestone (Figure 4). Thus, the absorption bed has an area distribution, the great filtration properties (the injectivity) are provided by a system of subhorizontal fractures.

The second zone is located in the upper part of the section and is established by complete absorption in well 185, in which it is connected with a thin bed which is porous according to the neutron-gamma logging. It is also manifested by partial absorption in the eastern part of the deposit (well 32).

Four main absorption zones have been established in the sedimentations of the Artinskiy stage. The first (lower) zone is located near the base of the section, 11-17 m from the roof of the Sakmarskiy stage (in connection with the incompleteness of the Artinskiy section, which was caused by a gap in the sedimentation, the correlation was made not to the roof of the stage, but to the more reliable Sakmarskiy datum mark). It is manifested by quite intensive absorption in the central part of the deposit (wells 27-D, 101, 106) and within the eastern part (well 32). The correlation of the sections of the latter and well 311 (a depth of 1,435.6 m) showed that the absorption is connected with a thin bed (1 m) of platy organogenic limestone, the thickness of the plates is 10-20 mm. This platy bed has an area distribution: it is also traced in wells 352 and 312, in the latter well its thickness decreased to 0.5 m.

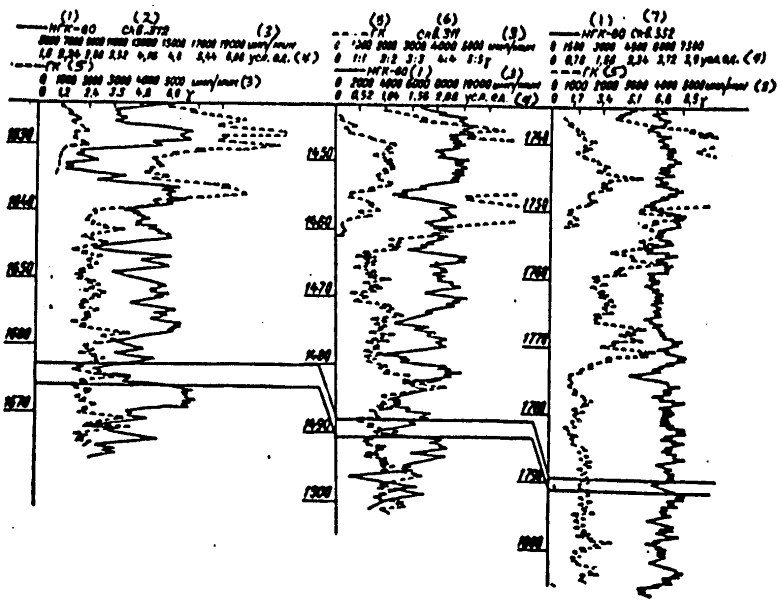

Figure 4. Diagram of the Correlation of the Lower Absorption Zone of the Sakmarskiy Stage Along the Line of Wells 312-311-352.

Key:

1. Neutron-gamma logging 60
2. Well 312
3. Pulses/minute
4. Conventional units
5. Gamma logging
6. Well 311
7. Well 352

The second absorption ,one is located 36-40 m from the base of the stage and is characterized by thu complete escape of the flushing fluid in well 116 and its partial escape in well 140. It was also established in the eastern half of the deposit by partial absorption in well 31. This zone is connected with a thin (0.5-1 m) bed of compact platy limestone which is traced according to the core sample of wells 352, 311 and 312 (36 m from the roof of the Sakmarskiy stage).

The third zone is located approximately 20 m from the above-described zone, in the upper part of the productive series of the central block of the deposit, and is characterized by the complete escape of the flushing fluid in wells 195 and 51, its intensive escape in well 713 and its partial escape in well 106. It is manifested by negligle absorption in well 32 and within the eastern block of the deposit. It is possible to judge the scale of this phenomenon by the steps to control it. In order to eliminate the complete escape of the drilling mud, 1,717 m^3 of mud with a density of 1.52-1.62 g/cm^3 with the addition of 4 m^3 of hypane, 12 tons of cement, 1 ton of cord, 30 m^3 of a special compound with a density of 1.26 g/cm^3, which was produced from bentonite powder, were injected into well 185. All this attests to the high filtration capacity of the bed and its area distribution. According to the core sample of well 311 (1,388.5-1,393.5 m) the absorption zone represents a 5-m thick bed of platy limestone which is friable and breaks down into dust and sand; the platiness is caused by a system of open subhorizontal fractures, the distance between them is 10-12 mm. In the section of well 352, which is located in the eastern part of the deposit, two thin (less than 0.5 m) beds of platy limestone correspond to it.

The fourth zone is noted only within the eastern part of the formation and is located 90 m from the roof of the Sakmarskiy stage. It is characterized by absorption in well 32 (21 m^3/hr).

The platy varieties of limestones are weak, are easily crumbled and broken by the hand, which does not make it possible to determine their permeability by the standard method. The fracture permeability according to the method of the All-Union Scientific Research Institute of Geological Prospecting for Petroleum in the case of an opening of 0.15 mm is 1 darcy. The estimate according to the formula used in hydrodynamic research yields a value of hundreds of darcy. The average matrix permeability of the rock collectors of the productive series equals 7.3 millidarcy. The permeability of the platy varities exceeds by a factor of 10^3 the matrix permeability, which makes it possible to single out a new type of collector--a platy supercollector with a superhigh permeability for Carbonaceous collectors.

What has been stated makes it possible to draw the following conclusions.

1. The hydrostatic pressure of the liquid column during absorption usually was 1.1- to 1.4-fold greater than the formational pressure and was 0.73-0.78 of the rock pressure.

2. The absorptions are connected mainly with thin (1-4 m) beds, the porosity of which ranges from 5 to 19 percent, most often being in the range of 10-13 percent.

3. The injectivity of the absorption beds is governed by a system of open subhorizontal fractures, which provide a superhigh permeability for Carbonaceous collectors.

4. The penetration of suspended (solid) particles of the drilling mud through the fractures, which was noted more than once in the core sample of new wells, attests to the openness of the fractures under bed conditions. The absorption of considerable amounts (up to 60-80 m^3) of the solid phase of the mud (bentonite, barium oxide), as well as the absence of accumulations of the latter in the bottom holes of wells with absorptions attest to this.

5. The highly permeable absorption beds have a more or less extensive area distribution. The comparison of the data on the injectivity of the bed and the amount of the injected solid phase of the mud makes it possible to assume a significant length of the fractures. This attests to the presence of superpermeable supercollector beds of considerable length.

6. The control of absorptions is leading to the sealing of the filtration routes of the beds with the solid phase of the mud and in practice "shuts off" the absorption zones near the given well from operation during subsequent recovery.

7. The maximum intensity of the horizontal fracturing, which is established in the absorption zones, is typical primarily for the anticlinal section of the Orenburg swell, which makes it possible to presume the tectonic nature of the fractures.

8. The supercollector beds, which are uniform in area, are manifested in the process of developing wells and working the deposit as the main channels of entry of the gas into the well and the primary objects of the early water seepage.

7807
CSO: 1822

FUELS AND RELATED EQUIPMENT

UDC 331.876.4(575.1)

RECENT UZBEKISTAN OIL, GAS EXPLORATION ACHIEVEMENTS TOLD

Moscow GEOLOGIYA NEFTI I GAZA in Russian No 11, Nov 78 pp 1-4

[Article by M. N. Urumov (Uzbekneftegazrazvedka): "The Labor Achievements of Uzbekistan's Petroleum and Gas Explorers"]

[Text] The Uzbekneftegazrazvedka [Association for Petroleum and Gas Exploration in the Uzbek SSR] collective, in implementing the historic decisions of the 25th Party Congress and later CPSU Central Committee plenums, has been working in an environment of great political and labor upsurge under the Tenth Five-Year Plan.

In solving the problems that the party advanced in regard to further raising the effectiveness of geological exploration and expanding the country's fuel-type raw materials, the oil and gas explorers, having promoted socialist competition, carried out ahead of time all geological tasks, both for the anniversary year and, in the aggregate, for the first 2 years of the current five-year plan, and it established conditions that are favorable for successful realization of the plan for increasing oil and gas reserves during the five-year plan as a whole. Uzbekistan's oil and gas explorers' collective has done much intensively planned work on geological study of the earth's depths and on improving the technology for drilling holes, and it has provided the republic's oil and gas producing industry with raw-material resources for the long term.

In 1965 a radical change in the equipment and technology for drilling and testing holes and improvement in the organization of work and production became necessary because of an expansion in exploratory work at areas that are marked by a buildup of anomalously high reservoir pressure. Since then geological exploration organizations have been rearmed with more modern drilling equipment and other technical resources. The problems of simplifying design of the holes and of converting to drilling with smaller-diameter bits under the intermediate casing are being resolved successfully. At the start of the Tenth Five-Year Plan the amount of drilling with sectional pipe rose sharply: this helped greatly to increase penetration per bit and the penetration rate.

The amount of hole testing done during drilling, using IPG-164 type formation testers, is being expanded, and ZPKRU-65-5 and PNK-89 perforators are being used more often. Hydraulic acid-fracturing of productive formations and hydrochloric-acid treatment of the critical area are being introduced.

The entire complex of measures that was executed permitted oil and gas explorers to carry out Ninth Five-Year Plan tasks successfully and to increase geological exploration effectiveness, thereby helping greatly to increase oil production in the Bukhara-Khiva region. Thus, the growth in gas reserves in standard fuel equivalents per meter of penetration rose 37 percent over 1966-1970 and its cost per ton dropped to 0.54 ruble from 0.73 ruble.

However, it was clear that the reserves for improving the equipment, technology and organization of prospecting and exploration for oil and gas still had not been exhausted. The need to seek basically new solutions became obvious.

With a view to further improving the management of geological exploration on the basis of Karshineftegazrazvedka [Karshi Petroleum and Gas Exploration Turst], Bukharaneftegazrazvedka [Bukhara Petroleum and Gas Exploration Trust], Uzbekgeofizika [Uzbek SSR Geophysical Administration] and the Karakalpak Petroleum and Gas Exploration Expedition, a production-type geological association for prospecting and exploring for oil and gas--Uzbekneftegazrazvedka--was established in 1974. Its composition also includes the Institute for Geology and Exploration for Oil and Gas Fields (IGIRNIGM).

For the first time in the republic's geological branch, all the oil and gas exploration subunits have been fused into a single organization, enabling the whole cycle of exploration for oil and gas to be conducted by one collective, from the stage of scientific substantiation and prospecting to the completion of exploratory drilling, estimation of reserves and transfer of the fields for operation.

Geological exploration for oil and gas in Uzbekistan is now being developed along the following main lines.

1. Prospecting and exploration for new buried reef structures in the Upper Jurassic sediments of the Chardzhou stage, which is marked by rather high promise. Preparation of the UV [hydrocarbon] reserves in this region is of great importance because of the presence of developed fields and a ramified pipeline net.

2. Prospecting and exploration for fields in the Mesozoic complex of the southwestern spurs of the Gissar Mountain Range. The potential for oil and gas reserves will enable this area to be viewed as one of the bases for further development of Uzbekistan's oil and gas producing industry.

3. Prospecting and exploration for fields in the Bukhara stage where oil and gas have been recovered successfully in past years.

However, the main region, where the greatest amounts of the association's drilling work is located, is the area of the Chardzhou stage, within which the main attention is being paid to a study of the structure and consistency in the spatial distribution of reef formations as well as of the methodology for mapping them.

Eight fields, seven of which (the Chandyr, Tegermen, Zapadnoye Khodzhi, Umid, Alan, Pirnazar and Markovskoye) are in the Chardzhou stage, have been discovered since the start of the five-year plan. The last four are connected with reefogenic formations and have rather promising reserves.

The new Amanata field, in the area of the southwestern spurs of the Gissar Mountain Range, where reliability methodology for preparing the subsalt structures is still lacking, has also been found. The position of the parametric hole by which the industrial productivity of the Upper Jurassic carbonaceous sediments was established was determined by a computational method, based upon the observed consistency of dislocation of the structures' arches and making use of the results of large-scale geological surveys. By analogy with the Adamtash and Gumbulak fields, a model of the hypothetical deposits was computed, and prospecting drilling began there in 1978.

Work done in 1978 created the prerequisites for discovering at least three new fields. This refers to the Yuzhnoye Zekry and Yuzhnoye Kamachi areas in the Chardzhou stage, where inflows of oil and gas were obtained during the drilling process by means of drill-stem testers, and to the Koshkuduk areas within the spurs of the Gissar Mountain Range, at which the first inflows of industrial crude have been obtained.

The review of UV reserves by USSR GKZ [State Commission on Mineral Resources] has been proceeding successfully during the Tenth Five-Year Plan. The oil and gas reserves of the Severnyy Urtabulak, Shurtan, Zevardy, Khodzhi, Alat and Pamuk fields have already been confirmed. In so doing, USSR GKZ recognized the quality of work on the Shurtan and Severnyy Urtabulak fields as excellent.

Because of the presentation for USSR GKZ review of intermediate Shurtan field reserves that previously had not been planned, the plan for USSR GKZ confirmation was fulfilled by 181 percent for gas and by 278 percent for oil and condensate.

The Shurtan field is second after Gazli. It has small area and high well productivity and is situated beside the existing Kelif-Murabek gas pipeline. This makes its development highly profitable. Exploration of the field continues and its reserves undoubtedly will be increased.

The work of the last 5 years in West Uzbekistan established the fairly wide development of reef traps and deposits in the Upper Jurassic carbonaceous complex, in which the reserves are characterized by very high density of product per unit of area. These traps form a complex target for exploration, since they are marked by great depth of deposition and by complexity of structure. We are now prospecting these deposits with seismic exploration and partially with parametric drilling.

In evaluating the geological effectiveness of the work done to prepare UV industrial reserves, it should be noted that the specific expenditure for preparation per ton of standard fuel equivalent has been cut in half, and growth in reserves per meter of penetration has been almost doubled versus the plan tasks for the first 2 years of the Tenth Five-Year Plan.

Considering the high pace of preparation of reserves, the explorers of Uzbekistan's depths are enabling the fields they have discovered to be transferred rapidly to industrial development. During the elapsed period of the five-year plan the Dengizkul'-Khauzak-Shady, Shumak, Khodzhikazgan, Khodzhi, Alat, Severnyy Urtabulak, Kuanysh, Zevardy and Pamuk fields, with total gas reserves that exceed the republic's production during the Tenth Five-Year Plan by more than 2.8 times, have been transferred to the operators.

Constantly implementing measures aimed at raising the effectiveness and quality of the work being done, the Uzbek geological explorers' collective fulfilled the plan tasks for the decisive year and the five-year counterplan for growth in explored industrial reserves of natural gas, oil and condensate ahead of time, back in August 1978.

The actual growth in UV reserves for the whole Ninth Five-Year Plan were surpassed during the preceding 2 years and 8 months. Natural gas increased by 10 billion cubic meters or more than it did during 1970-1975, and, by the end of 1978 the indices for the year will grow, probably even doubling.

The results achieved are inseparably linked with constant improvement in the methodology for prospecting, the wide introduction of new methods and modifications of geophysical research (MOG [inverse-time method] and MOGT), which enabled the informativeness of the data received to be raised. Scientific-research institute collectives achieved definite successes in the substantiation of areas of geological exploration, the development of problem-solving questions of oil and gas geology, and forecast evaluation of the prospects for the presence of oil and gas in various regions of Uzbekistan.

Such are the main results of prospecting for oil and gas in the republic. The following should be recognized as the main results of the work done during the expired period of the five-year plan that are of basic importance:

a) The preparation and turnover for industrial development of the Severnyy Urtabulak oilfield;

b) USSR GKZ confirmation of the substantial gas and condensate reserves of the Shurtan field;

v) The discovery of new gas and condensate fields (the Umid, Alan, Pirnazar and Markovskoye) that are associated with reef massifs; and

g) The acquisition of direct shows of oil during drilling at a number of areas (the Yuzhnoye Zekry and Yuzhnoye Kemachi), which presents grounds for evaluating more optimistically the possibility of discovering new deposits of oil within the Chardzhou stage.

A decisive factor in increasing the association's work effectiveness has been constant, systematic improvement of the organization of management, based upon specialization and concentration of production, which has enabled the efforts of collectives to be directed toward the improvement of highly specialized matters of equipment, technology and operating procedures in all elements of the multifaceted performance of both basic operations and subsidiary and auxiliary operations. Dissemination of advanced experience and improvement in forms of socialist competition helped here. Competition by vocations and among cooperating activities was propagated.

As a result, the association's collective has been operating, from the day of its formation, without organizations or enterprises that lag, and the republic's explorers for oil and gas have emerged as All-Union socialist competition winners 27 quarters in a row.

The association's collective was awarded the Emblem of Honor for successful preparation of industrial reserves and for raising the economic effectiveness of geological exploration for oil and gas during the Ninth Five-Year Plan.

The start of the Tenth Five-Year Plan was marked by a powerful upsurge in socialist competition, as a result of which the association was awarded in 1976 and 1977 the challenge Red Banner of the CPSU Central Committee, the USSR Council of Ministers, the AUCCTU and the Komsomol Central Committee, with a recording thereof (1977) on the VDNKh [Exhibition of Achievements of the National Economy] Honor Plaque.

The association's collective was entered in the Book of Labor Glory of the Uzbek SSR for high indices in executing the decisions of the 25th CPSU Congress and the 19th Congress of the Uzbekistan Communist Party, for active participation in socialist competition to raise production effectiveness and quality, for fulfilling Ninth Five-Year Plan tasks ahead of time and for successes in communist training.

The brigades under Heroes of Socialist Labor S. K. Karimov and Kh. Temirov and Order of Labor Red Banner holders A. Tilyakov, T. Alimkulov and A. Karimov have good, stable indices.

During the last 2 years of the current five-year plan 44 of our workers were awarded orders and medals of the Soviet Union. Among those marked for the Order of the October Revolution were drilling master Kh. Safarmatov, Order of Labor Red Banner driller of the well-testing expedition A. Karimov, and many others. Six of our comrades received the honorary title of Distinguished Specialist of Uzbekistan and nine advanced workers were awarded the Honorary Certificate of the Presidium of the Uzbek SSR Supreme Soviet. Driller U. Amanov of the Kasan NGRE [Oil and Gas Exploration Expedition] received the high title of Leninist Komsomol Prize Laureate for 1977.

The recognition of service has inspired the explorers of Uzbekistan's depths to new labor victories. The trip of CPSU Central Committee General Secretary and USSR Supreme Soviet Presidium Chairman Comrade Leonid Il'ich Brezhnev about areas of Siberia and the Far East stimulated a powerful labor upsurge, in response to which the association's collective adopted increased socialist commitments to increase gas reserves in 1978 by 20 billion cubic meters without additional funds or material resources being allocated to us. We are happy to report that our collective had, by the first anniversary of the USSR Constitution, carried out with honor the commitment that it had undertaken. Uzbekneftegazrazvedka oil and gas explorers are filled with resolve to make a worthy contribution to execution of the historic decisions of the 25th CPSU Congress, helping the growth of the country's economic potential in every possible way.

11409
CSO: 1822

FUELS AND RELATED EQUIPMENT

UDC 550.81.003.13(470.1/.6=17)

IDENTIFYING PROMISING OIL, GAS FIELDS IN NORTH, SIBERIA SYSTEMATIZED

Moscow GEOLOGIYA NEFTI I GAZA in Russian No 11, Nov 78 pp 5-10

[Article by A. V. Ovcharenko (RSFSR Ministry of Geology), V. V. Mukhin, E. A. Yengalychev and V. I. Nazarov (VNIGRI [All-Union Petroleum Scientific-Research Geological Exploration Institute]): "Ways to Raise the Effectiveness of Prospecting and Exploration in Siberia and the North of the European Part of the USSR"]

[Text] By way of discussion.

The Main Directions for Developing the USSR's National Economy During 1976-1980 points out the great significance of speeding up prospecting and exploration of new oil and gas fields in regions of Siberia and the North of the European part of the USSR (the Komi ASSR and Arkhangel'skaya Oblast). Successful geological exploration will increase considerably the raw materials base of the oil and gas producing industry that is being developed intensively here. The task is impossible of solution without increasing the economic effectiveness of geological exploration, improving the quality of preparation of reserves, and providing for a pace in growth of reserves that will outstrip the pace of the development of production.

During 1971-1975, 85 oil and gas fields were discovered in Siberia and the North of the European part of the USSR, including 70 in West Siberia (in 1966-1970 the figures were, respectively, 81 and 59). While in 1966-1970, 13 percent of all the fields found in the country were in West Siberia, in 1971-1975 the figure was 19 percent.

The status of explored oil reserves in these regions is creating the prerequisites for a rapid increase in production. The greatest growth thereof is planned for West Siberia, from 147.6 million tons in 1975 to 300-310 million tons in 1980. Substantial gas reserves have been prepared in the Komi ASSR, West Siberia and Yakutia. Even now they can practically support recovery in the range of 500-800 billion cubic meters per year.

Geological exploration successes in the country's northern regions result primarily from work done there in the most promising areas and from the constant increase in funds allocated thereto. Prior to 1966 expenditures for preparing reserves as a whole for the territories being examined doubled every 5 years. Although the growth rate has slowed in the last decade, it continues to be substantial: in 1966-1970 total expenditures increased by 1.5 times and in 1971-1975 by 1.55 times. The economic effectiveness of preparing oil and gas reserves in these regions is extremely high.

At the same time it must be noted that in recent years the successfulness of deep drilling has started to decrease, and expenditures for preparation per unit of reserves has increased. This has been occasioned by the increase in the extent to which both regions have been explored--by the discoveries of the most important oil and gas fields during the preceding five-year plan.

The deterioration of the main effectiveness indices for prospecting and exploring has been provoked also by the shifting of the operating front to the northern and eastern regions, by the increase in the depths of the search and by a complication of geological conditions.

In order to smoothe out the manifestation of these unfavorable tendencies, all opportunities for raising geological and economic effecitveness of prospecting and exploring for oil and gas should be implemented. It is necessarily primarily:

To improve reliability in forecasting the presence of oil and gas, with a view to choosing correct directions for geological exploration;

To use in practice precise economic criteria that will enable the most promising facilities to be singled out for prospecting and exploring the fields; and

To use more modern methodology, which calls for optimal variants (balanced with the geological prerequisites and with the economic criteria) for preparing reserves by types and stages of operations.

The economic desirability of conducting prospecting or exploration at one target or another, taking into account all circumstances that will support high effectiveness in the preparation of reserves and in the use thereof, is not always being evaluated now.

Paying attention to the indicated circumstances, VNIGRI staff workers have developed a methodology for determining the economic desirability for conducting geological exploration that is based upon an analysis of the maximum operating costs for preparing reserves. Figures 1 and 2 show nomograms that enable the establishment of indices for the preparation of oil reserves for certain areas of West Siberia and the Komi ASSR that are permissible under economic criteria.

The constituent elements of the nomograms are the curves for the maximum (1-5) and expected (I-V) operating costs for preparing 1 ton of reserves. The first reflect the degree of dependence of specific expenditures for the preparation of 1 ton of reserves at the depth of deposition of the productive horizons, the size of the fields' reserves and, especially, the flows of the wells (A, Б , B, Г and Д). The second indicate the expected operating costs for preparing 1 ton of reserves at fields that differ in amount and in depth at which the deposits are found. The expected operating costs grow with increase in depth of the productive horizons and with decrease in the fields' reserves. The points of intersection of both curves, which correspond to an indentical amount of reserves of the fields, indicate the depths of deposition of the productive horizons at various well flows that are permissible in accordance with economic considerations.

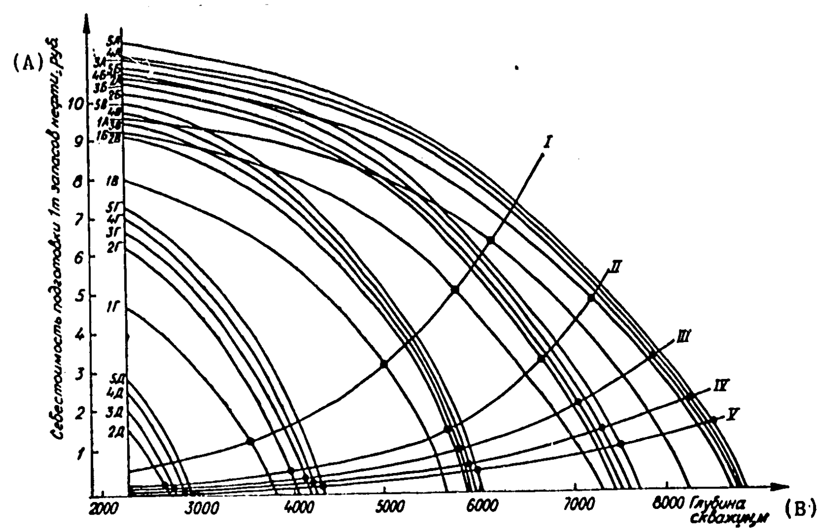

Figure 1. Nomograms for Determining Indices That Are Permissible under Economic Criteria for the Preparation of Oil Reserves in One of the Regions of West Siberia.

Expected operating costs for preparing 1 ton of crude at fields with reserves (in millions of tons): I—$\leq$10, II—11-30, III—31-50, IV—51-100 and V—>100.

Maximum operating costs for preparing 1 ton of crude at fields with reserves (in millions of tons): I—$\leq$10, 2-11-30, 3—31-50, 4—51-100 and 5—>100.

Well flows (in tons per day): A—150; Б—100; B—50; Г— 20 and Д —10.

Key:
A. Operating costs for preparing 1 ton of oil reserves, in rubles.
B. Depths of wells, meters.

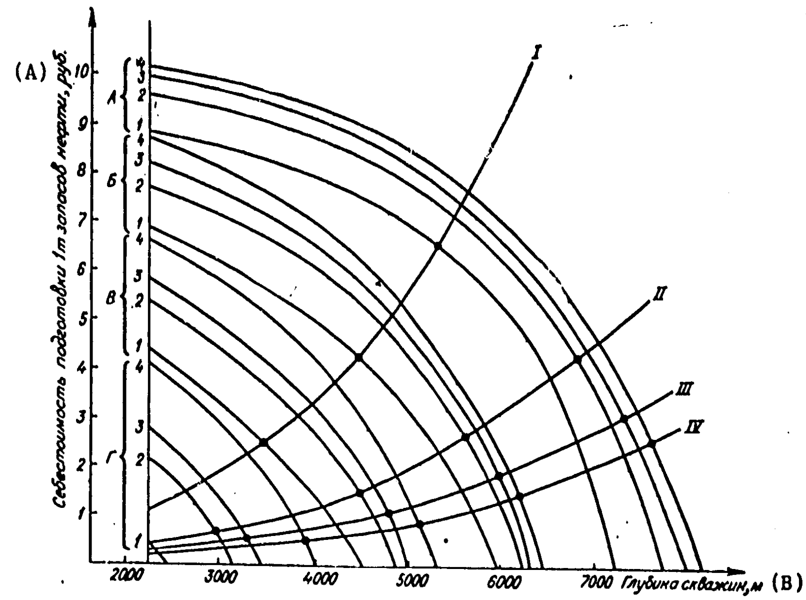

Figure 2. Nomogram for Determining Indices That Are Permissible Under Economic Criteria for the Preparation of Oil Reserves in One of the Regions of the Timano-Pechora Province.

Maximum operating cost for preparing 1 ton of crude at fields with reserves (in millions of tons): I--≤10, 2--11-30, 3--31-50 and 4--51-100.

Well flows (in tons per day): A—100, Б—50, B—30 and Г—20.

For conventional symbols I-IV, see figure 1.

Key:
A. Operating costs for preparing 1 ton of oil reserves, in rubles.
B. Depth of wells, meters.

An analysis of the nomograms that were compiled for West Siberia indicate the following (see figure 1).

The smaller the reserves of a field that is to be explored, the more rigid the demands that must be placed on it in relation to the amount of well flow and the depth at which the productive horizons are located. Thus, in the modern era of mastering individual oil-bearing regions, fields with reserves of less than 10 million tons and flows below 10 tons per day do not fall within the area of economically permissible conditions. Where there is such well productivity, a field with reserves of more than 10 million tons at a depth of less than 2,950 meters (see figure 1, points II-2Д, III-3Д, IV-4Д and V-5Д) can be readied for development.

The extent to which the economic prerequisites are met is expanded as the reserves of the fields and well-flow characteristics increase. Where flows are no less than 20 tons per day, exploration of practically all small fields is permissible where the productive horizons do not lie below the -3,500 meter grade level (see figure 1, points I-1Г).

At contemporary prices for oil and petroleum products and considering the circumstances of the area being examined, exploration of deposits at depths of more than 4,500 meters is economically desirable where well flows are no less than 50 tons per day (see figure 1, point I-1B). These requirements are being made stricter for those areas where the cost of prospecting and exploration are higher than in the region being examined.

The conclusion drawn is being confirmed also by calculations carried out for one of the areas of the Timano-Pechora oil and gas bearing province (see figure 2). The higher cost of drilling and of erecting wells affects the values of the maximum economic indices for the exploration of fields. Thus, the development of fields with reserves of less than 10 million tons will be profitable here only where oil well flows are about 30 tons per day and depths of deposition of the production horizons are less than 3,500 meters (see figure 2, point I-1B). In the case of larger reserves, exploration of a field is justified where well flows are 20 tons per day (see figure 2, points II-2Г, III-3Г and IV-4Г).

It must be specified that the situations that have been examined relate to fields that are remote from existing or planned oil and gas pipeline routes. If small fields are discovered close to existing arterial pipelines or to those that are under construction, their importance increases and the necessity for exploration is determined by special calculations.

A few words must be said about Yakutia's gas fields, which are located at a great distance from possible customers for this raw material. High transportation costs reduce the effectiveness of its use. Moreover, developing the fields will be rather expensive. The conduct of prospecting and exploration here can be economically desirable only where the fields are large enough and sufficiently high flows are discovered.

The sharp rise in prices on the world market and, judging by forecasts, the persistence of this trend can lead, in the long term, to Yakutia's gas becoming a subject of export—a source of large foreign exchange receipts. In this case, the demands on the geological and technical parameters will be reduced, since the demands on economically justifiable reserves and productive wells will be completely different.

The opinion exists that an economic assessment of fields and of their parameters can be made only after exploration is completed. If this point of view is adopted, then it is impossible to determine the economic desirability of conducting geological exploration at the early stages of study of a region.

Abroad, the question about the profitability of developing possible fields is studied in parallel with adoption of the decision about renting a promising section, and it is refined as geological information is received.

Under our circumstances also, a practice that will enable expenditures for the preparation of oil and gas reserves that do not meet specifications to be averted should be introduced.

The proposed criteria for evaluating geological exploration effectiveness in the form of the dependence of the maximum and expected operating costs for preparing reserves on the depth at which the productive horizons lie and on increases in the reserves of the fields and in well flows undoubtedly requires further improvement. Work should be done in this area jointly with specialists of the geological services and the oil and gas industries. In so doing, such factors as remoteness of the areas being explored from transportation routes, the status of the buildup of the areas and the possibility of accelerating the introduction of the explored reserves into operation should be considered.

The introduction of economic criteria into geological exploration is possible where there is a rise in the methodological level and quality of this work, and also where the planning system is improved.

For regions of the Komi ASSR, Arkhangel'skaya Oblast and Western and Eastern Siberia, the requirements for drilling anticlinal uplifts should be concretized to the extent that it is possible to establish the economic desirability of and the priority for conducting detailed geological and geophysical studies and prospecting drilling thereat.

The structures should be characterized not just from the point of view of their dependability and their dimensions. No less important is the consideration also of a number of additional geological and technical parameters--the amount of promising reserves, the depths at which the prospective oil and gas bearing complexes lie, the potential quality of the UV's [hydrocarbons], and the productivity of the probable deposits. The indicated work can be done by the operating organizations with the participation of territorial and head institutes.

The use of rational methods to prospect for new deposits is acquiring exceptional importance.

An accelerated modification of prospecting must be used more often at large and high-amplitude uplifts that have been established by seismic exploration and that are located in structural facies zones where the presence of oil and gas in industrial amounts has been proven; after the structures are found, it is necessary to drill single parametric holes or prospecting holes at them at once, and, following the discovery of fields (or deposits)--undertake detailed mapping of the productive sediments at the uplifts by geophysical methods with a view to determining the optimal prerequisites for further positioning of holes.

Such a methodology has been used successfully at a number of areas of the Timano-Pechora province and in certain other oil and gas bearing regions of the country. As a whole, it helped to speed up exploration and reduced the amounts of exploratory drilling during the mastery of UV fields.

Many years of prospecting experience have indicated that where this work is of high quality, it is sufficient in 85 percent of the cases to drill not more than two or three prospecting holes in order to determine the area of the productive horizons, the depths of deposition and productivity, and also the quality of the hydrocarbon fluids. An increase in the number of holes proves irrational for reasons either of small size of the fields discovered or nonproductivity of the area.

A limitation on the number of holes sets high requirements on prospecting methodology. Thus, the first holes should, to the extent possible, find all the main productive horizons, which is provided for by reliable prognosis of the location of the deposits in the structure, by failure-free drilling and by completeness and high quality in the validation of both the productive and the water-bearing horizons. It is necessary to strive to assure that all the deposits in the cross-section that is opened up are found by the first holes, since the number of deposits is of decisive importance in clarifying the industrial significance of the field.

The choice of optimal drilling depths in poorly studied regions also plays a role of no small importance. Opening up the first hole of sedimentary cover at maximum depth often leads to the upper and more easily mastered productive horizons not being explored adequately, for technical reasons, when establishment of the presence of oil and gas in these intervals would permit prospecting effectiveness to be raised considerably. Therefore, if it is thought that there is more than one productive complex in the cross-section, then prospecting should be accomplished by several holes planned for various depths. The establishment of the presence of oil and gas in industrial quantities in the upper parts of the cross-section will enable the exploration of ancient sediments to be boosted and preparation of the field for introduction into development to be speeded up.

The high potential possibilities of the gas and oil bearing regions and of the promising regions that are being examined do not exclude the probability of discovering there fields that do not have important practical significance. Their exploration, naturally, is not a priority task, but they can be of interest as a target for development in the foreseeable future.

At fields that are found by prospecting drilling, later work should be done in two stages. Initially, under a preliminary variant of exploration, it is necessary to determine the industrial significance of the field according to the amounts of the S_1 and S_2 reserves and to establish the desirability of preparing the field for development. A share of S_1 category reserves--about 50 percent--testifies to the promise of the evaluation. In this connection, it is recommended that the task for growth of S_2 category reserves be included in the plan that is established within the industry for geological exploration organizations. S_2 reserves should become a base for the tasks planned for the organizations with regard to growth of reserves of higher categories, primarily S_1.

The formulation of geological tasks on the basis of category S_2 reserves already known that are tied to concrete deposits will enable geological exploration organizations to orient themselves to the exploration of the largest targets and to a further accumulation of promising reserves.

The optimal variant for further development of a field is adopted as a function of economic circumstances. Work experience in various oil and gas bearing regions of the country indicate that the following can prove to be rational:

a) The introduction of a field into development while it is being proved with the drilling of anticipatory production wells--expenditures for exploration are reduced and the level of growth of reserves achieved is retained;

b) Industrial exploration and turnover for the buildup of oilfield facilities at the fields that are most important for developing production--this provides also for a growth of reserves and the conquest thereof; and

v) Temporary mothballing of a field as a reserve for later industrial development (or proving) prior to introduction into operation--"freezing" of resources released for exploration is reduced.

At all stages of prospecting and exploration, a geological and economic evaluation of the results obtained must be made: a determination, on the one hand, of the economic effectiveness of carrying out a set of operations, and, on the other, of the economic desirability of continuing them. Only under this circumstance (which is just as obligatory as other types of operating activity) is it possible to count on correct preparation of explored reserves during the Tenth Five-Year Plan.

Converting to the geological and economic substantiation of operations at the various stages will help to find the permissible amounts in in-kind and monetary indices. They can become the economic standards for concrete geological tasks.

BIBLIOGRAPHY

1. Leybson, M. G., "A Methodology for Computing Standards for Indices of the Effectiveness of Geological Exploration," EKONOMIKA NEFTYANOY PROMYSHLENNOSTI [Economics of the Petroleum Industry], No 2, 1976, pp 9-13.

2. Leybson, M. G. and Nazarov, V. I., "Ways to Solve the Problem of the Economic Evaluation of Deposits," GEOLOGIYA NEFTI I GAZA [The Geology of Petroleum and Gas], No 10, 1973, pp 8-10.

3. Nazarov, V. I., Il'insky, A. A. and Pimenov, N. I., "The Substantiation of Maximum Economic Indices for the Prospecting and Exploration of Oilfields," EKONOMIKA NEFTYANOY PROMYSHLENNOSTI, No 9, 1977 pp 3-7.

11409
CSO: 1822

END